Preliminary Data Report

For Sakonnet River (Portsmouth Park) / The Cove – Island Park

Total Maximum Daily Load (TMDL)

For Fecal Coliform

FINAL

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1 INTRODUCTION

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting water quality standards and thereby not meeting the designated uses. The goal of the TMDL process is to reduce loadings to a waterbody in order to improve water quality such that State Water Quality Standards are met and all designated uses are attained and maintained. The Sakonnet River (Portsmouth Park) and The Cove (Island Park) were both identified on Rhode Island's 1998 303(d) list as being impaired by pathogens. Figure 1 provides a delineation of the location and area of the listed waterbodies. This report is a compilation of existing information from available sources and will be used in developing the TMDL for the two waterbodies.

1.1 BACKGROUND

The Sakonnet River (Portsmouth Park) and The Cove - Island Park are listed on the RI 1998 303(d) List of Impaired Waters because they do not support all designated uses for Class SA waters. Both areas are delineated in Figure 1 and are defined as follows:

> **"Sakonnet River (Portsmouth Park):** The waters of the Sakonnet River north of a line extending from the southwestern-most corner of the stone bridge in Tiverton to the eastern-most extension of Morningside Lane in Portsmouth.
>
> **Island Park – The Cove:** That portion of The Cove in Portsmouth south of a line from the southern end of Hummock Point to the RIDEM range marker located at the eastern extremity of a point of land on the western shore of The Cove."

Both listed areas have been classified by the RIDEM Office of Water Resources Shellfish Program as "polluted" areas and both areas (as they are currently delineated) have been permanently closed to shellfishing since May 1988. This designation was primarily based upon the results of several shoreline surveys performed by RIDEM Shellfish Program staff during 1987 and 1988.

The persistence of the high fecal coliform discharge in the Portsmouth Park storm drains, as well as the documentation of failing septic systems in Island Park, prompted RIDEM to conduct a two-year, EPA-funded study of the contamination problem from 1996 to 1998. The goal of the study was to develop and implement a standard approach for the State to re-open polluted shellfishing areas. The first step involved identifying failed septic systems and illegal cross connections between cesspools or septic systems and stormwater systems in the study area of Island Park and Portsmouth Park. The second step involved researching new and alternative sewage treatment technologies, as well as financing strategies and funding mechanisms. A draft report was written for the project. Information from that draft report was included in this document.

A Wastewater Facilities Plan Report, completed for the Town of Portsmouth in 1980, recommended the construction of a municipal sewage treatment facility as the solution to the sewage pollution problems in Island Park and Portsmouth Park. Town residents voted upon and rejected the plan. The Town currently does not have a municipal wastewater treatment system available to treat sewerage.

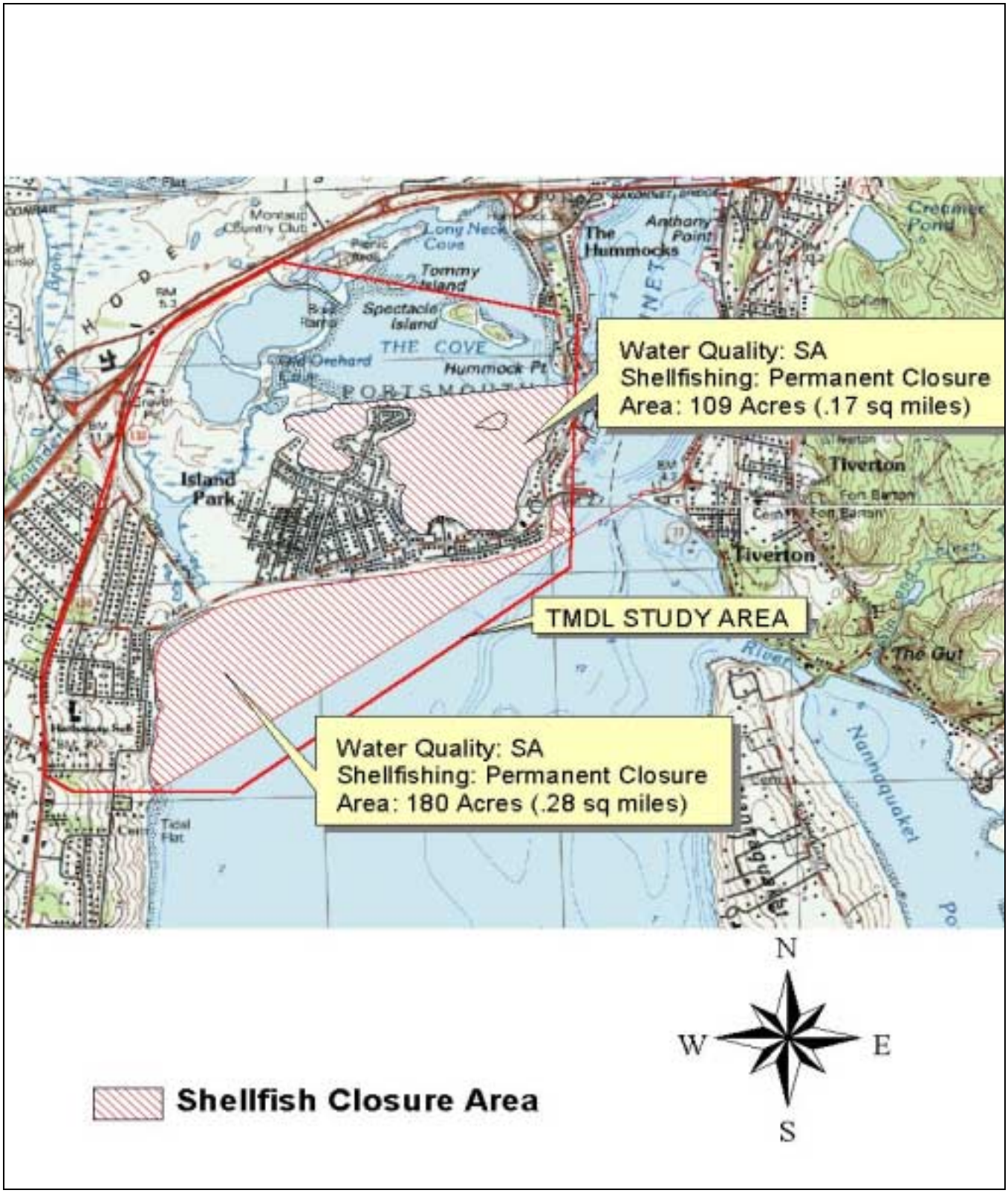
A Comprehensive Community Plan prepared by the Town of Portsmouth (September 1992) acknowledged the magnitude of the contamination problem, but estimated that the cost for a full scale sewage treatment plant and collector lines would be greater than $80 million. The plan assumed that Portsmouth would not have a full-scale sewer system operational within the twenty year planning period. Among the objectives stated in the 1992 plan was establishing several localized community sewerage systems in critical areas and studying the feasibility of establishing Wastewater Management Districts in areas with soil deemed unsuitable for septic systems. This plan lists both the Island Park and Portsmouth Park areas as problem areas where localized treatment systems should be considered. It was noted that alternative technology systems should be explored, particularly considering the prohibitive cost of conventional treatment and the difficulty anticipated in locating a suitable site.

The Town of Portsmouth was recently awarded a RI Small Cities Community Development Block Grant to investigate wastewater issues in Island Park and Portsmouth Park. The Project, titled "Wastewater Facilities Plan (WWFP) Update for the Island Park and Portsmouth Park Areas of the Town of Portsmouth, Rhode Island", will evaluate different wastewater management alternatives. The Town intends to review available information and develop a plan to correct wastewater and stormwater pollution in the area. The Portsmouth Town Planner will manage the project and a preliminary plan is anticipated fourteen months from initiation of the project.

The Town of Portsmouth was also awarded a Non-Point Source Pollution Abatement Grant for developing a strategy to manage Individual Sewage Disposal Systems (ISDS) in town. The project, titled "Wastewater Management Plan for a Community ISDS Repair Program for Portsmouth" will develop a wastewater management plan, which would then make the Town eligible for the low-interest Community Septic System Repair Program (CSSLP). The Town anticipates that this opportunity will be an incentive to homeowners to repair or replace their older septic systems.

Until wastewater treatment facilities are available, the creation of a Waste Water Management District (WWMD) is a realistic alternative for the management of existing ISDS. The Town of Portsmouth acknowledges that a municipal sewerage system may be the most appropriate means for treating sewage in large, densely populated communities such as Island Park and Portsmouth Park.

Figure 1 – Sakonnet River – Portsmouth Park / Island Park Shellfish Closure Lines



2 APPLICABLE WATER QUALITY STANDARDS

All surface waters of Rhode Island have been categorized according to a system of water quality classification based on consideration for public health; recreation; propagation and protection of fish and wildlife; and economic and social benefit. Each class is identified by the most sensitive and therefore governing use to be protected. Surface waters may be suitable for other beneficial uses, but are regulated to protect and enhance designated water uses. It should be noted that water quality classifications reflect water quality goals for a waterbody and may not represent existing water quality conditions (Water Quality Regulations, 1997).

The establishment of in-stream numeric endpoints is an integral component of a TMDL, and they are used to evaluate the attainment of acceptable water quality conditions. In-stream numeric endpoints represent the water quality goals that are to be achieved by implementing the load reductions specified in the TMDL. The endpoints allow for a comparison between current in-stream conditions and conditions that are expected to restore beneficial uses; the endpoints are usually based on either the narrative or the numeric criteria described in the state's water quality standards.

Both "The Sakonnet River (Portsmouth Park)" and "The Cove (Island Park)" are designated as Class SA waters (saltwater). Designated uses for Class SA waters are described in The Rhode Island Water Quality Regulations, as the following:

> ***"Class SA waters:*** These waters are designated for shellfish harvesting for direct human consumption, primary and secondary contact recreational activities, and fish and wildlife habitat. They shall be suitable for aquacultural uses, navigation and industrial cooling. These waters shall have good aesthetic value."

The fecal coliform standard for Class SA waters is established in Rule 8.D of the Water Quality Regulations. That standard specifies that the maximum allowable level of fecal coliform bacteria (Most Probable Number (MPN) per 100 milliliter) may not exceed a geometric mean MPN value of 14, and not more than 10% of the samples shall exceed an MPN value of 49, for a three-tube decimal dilution (Water Quality Regulations, 1997).

The impaired areas designated as "The Sakonnet River (Portsmouth Park)" and "The Cove (Island Park)" and are included in the Narragansett Bay watershed. The impaired area designated as The Cove (Island Park) encompasses the southern half of the cove or 109 acres (0.17 sq. miles) called Blue Bill Cove. There are no residential dwellings located to the north or northwest of "The Cove" so waters in the northern portion are classified as approved for shellfishing. The impaired area accounts for approximately 50% of the total area of "The Cove". The impaired area designated as "The Sakonnet River (Portsmouth Park)" encompasses 180 acres (0.28 sq. miles) of the upper Sakonnet River. The impaired area accounts for less than 5% of the total area of The Sakonnet River.

Although both areas are permanently closed to shellfishing, the RIDEM Shellfish Program's ambient water quality monitoring data show that fecal coliform concentrations at the sampling stations within the shellfish growing areas do not exceed Class SA standards for fecal coliform bacteria. However, the high density of fecal coliform inputs present in the Portsmouth Park storm drain discharges exceed the standards set forth by both the RI Water Quality Regulations and the National Shellfish Sanitation Program (NSSP). The potential public health risk associated with the possibility of direct discharge of human septage waste from failing septic systems into the shoreline area prompted the shellfishing ban.

Consequently, the designation of the area as prohibited for shellfishing directly impacts the designated shellfishing use for Class SA waterbodies and resulted in the listing of both areas on the 1998 303(d) List of Impaired Waters.

3 DESCRIPTION OF WATER BODY

The Sakonnet River (Portsmouth Park) and "The Cove" (Island Park) are coastal waters located in the East Bay Section along the northeast coast line of Aquidneck Island in the town of Portsmouth, Rhode Island. The two waterbodies are classified as SA waters and are ranked within Group 1 (highest priority) of the state's 303(d) list of impaired waterbodies. The pollutant of concern is pathogens, as indicated by fecal coliform. This determination was a direct result of the RIDEM Shellfish Program's delineation of a permanent closure area encompassing approximately one hundred and eighty (180) acres (.28 sq. miles) of the Sakonnet River and one hundred and nine (109) acres (.17 sq. miles) of The Cove (Figure 1).

These two areas do not currently meet the minimum water quality standards of SA waters, as they are unable to support the designated uses of those waters. Specifically the results of several shore line surveys, conducted by the RIDEM Shellfish Program, and the evidence of failing septic systems indicate that the threats of contamination exceed the standards set forth by the National Shellfish Sanitation Program. The potential for a public health risk associated with the consumption of contaminated shellfish resulted in the closures of these two areas.

4 DESCRIPTION OF THE WATERSHED

The Town of Portsmouth was originally established in 1638. In June 1898 an electric trolley started operating between Fall River (MA), and Newport, and soon after, a summer colony started at Island Park. A comparison of USGS Topographic Maps produced in 1891, 1907, 1949 and 1975, show a transition towards a high development density. The 1891 map depicts no houses in the study area. In the 1907 survey, the Portsmouth Park area shows the trolley line and only six waterfront cottages. Soon thereafter, it was platted into approximately 120 narrow waterfront and water-view lots. The 1975 contour map shows occupancy on all the originally platted Portsmouth Park lots, upland development and an additional adjacent two hundred (200), ten thousand (10,000) square foot lot development. Many of the shoreline homesites have cement slabs that extend into the high tide watermark. In addition, farmland, upland from the original waterfront cottages had been replaced by an elementary school.

4.1 LAND USE

Today, this community is heavily populated with year-round residents, and many “summer cottages” have been converted to year round residences. The lots are small (Figure 2) and many of the cottages are closely situated (Figure 3), as can be seen in the aerial photograph. A current land use map (Figure 4) identifies the only open areas as the school grounds, a farm field and some wet lots (i.e. high water table). The western shore of The Cove consists of brushland and wetlands that essentially create a divide between the Island Park and Portsmouth Park Plats.

The greatest percentage of the land use in Portsmouth Park, Island Park, and the adjacent area is urban-residential and commercial/industrial, which renders a significant percentage of the surface area impervious. Paved roads, parking areas, buildings and other community developments have occurred in areas containing soils that are poorly drained and unsuitable for high-density development where onsite sewage disposal is the only means of wastewater elimination available.

4.2 SOILS

The soils present within the Upper Sakonnet area are generally not suitable for the disposal of sanitary wastes (Figure 5); Portsmouth Park and Island Park are comprised of two distinctly different soil types. Portsmouth Park soils are poorly drained and contain a dense shale impervious layer close to the surface. This hillside community slopes from the west to the east toward the shoreline, which serves to convey groundwater from the upland area to the point of discharge along the shore.

According to the Soil Survey of Rhode Island, soil in the Portsmouth Park area is classified as primarily Newport-Urban land complex. This soil complex is characterized as having a moderately rapid to rapid permeability in the upper soil layers, while having a slow to very slow permeability in the substrate. Presumably, groundwater moves rapidly, both vertically and horizontally through the upper layers, yet is restricted by the substrate. This uneven permeability can result in an extended wet surface soil condition after rain events and could explain Portsmouth Park’s wet and constantly draining condition. The Soil Survey of RI considers the soil complex underlying Portsmouth Park as “limited” for onsite sewage disposal systems due to the slow permeability in the substratum.

In contrast, soil in the Island Park Plat is classified as Merrimac Urban Land Complex, which consists of about 40 percent well-drained Merrimac soils and 40% Urban land (SCS, 1981). This soil type demonstrates a moderately rapid permeability in the surface layer and upper part of the subsoil, moderately rapid to rapid in the lower part of the subsoil and rapid in the substratum. The Soil Survey recommends that installation of onsite septic systems in this soil include careful design to prevent pollution of groundwater. Additionally, the shoreline of Island Park is a sand bar, which facilitates rapid water movement to the shore. In Island Park, the presence of old, inadequate or failing septic systems in the sandy soils likely contribute fecal coliform through groundwater flows directly into The Cove on the north side.

Soil types were verified through additional core samples taken in the Portsmouth/Island Park area. The study area soils were confirmed to be of two different types. Portsmouth Park soil is poorly drained and has a dense shale impervious layer close to the surface. These conditions cause seasonally high groundwater and are evident by the areas upland and beach "springs". Island Park in contrast, is a sand bar with rapid water movement through the soil.

Figure 2 – Parcel Map – Portsmouth Park and Island Park

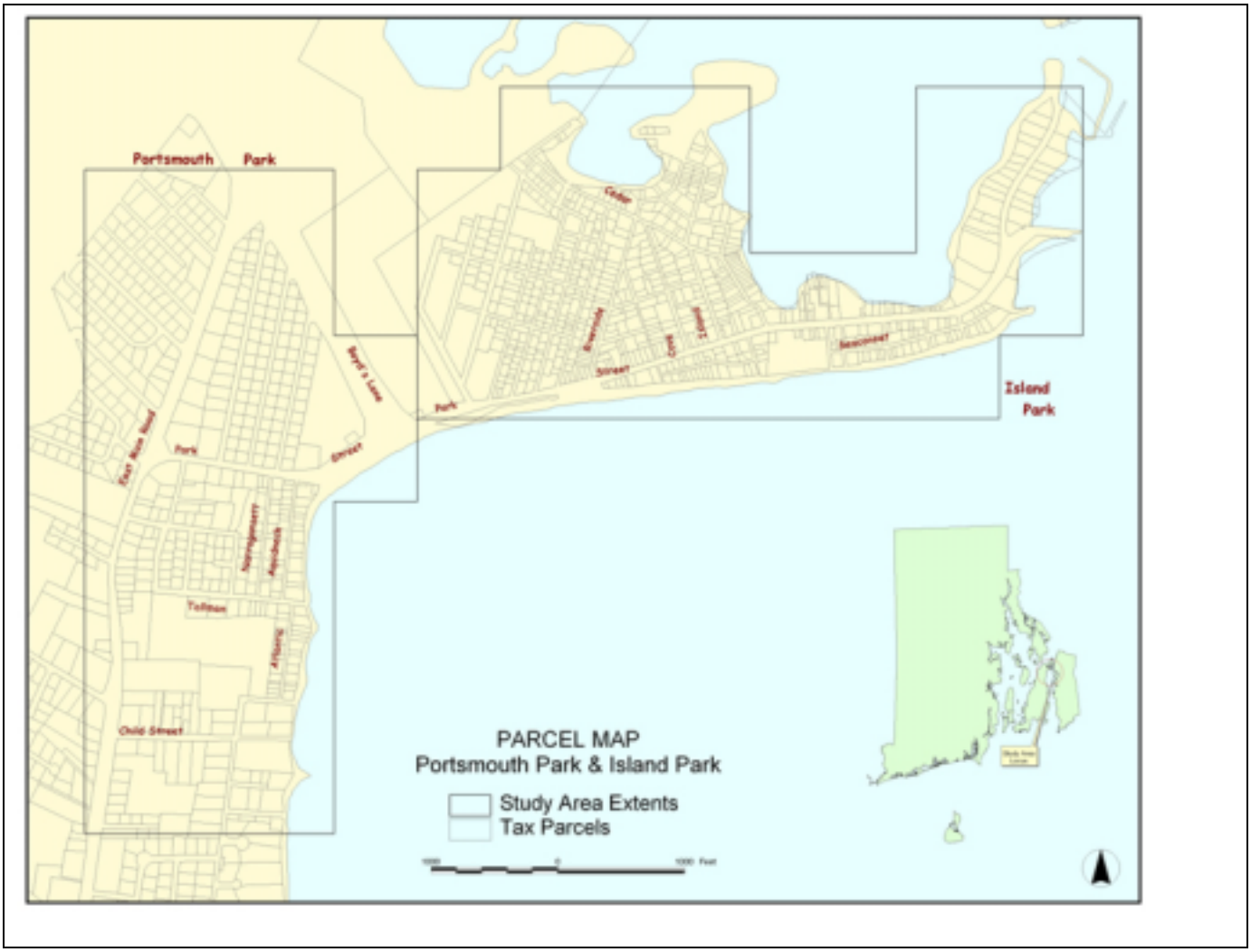


Figure 3 – Portsmouth Aerial Photograph

PHOTO COURTESY OF
MIT DIGITAL ORTHOPHOTO
UNIVERSITY OF RHODE ISLAND

Figure 4 – Portsmouth Land Use Map

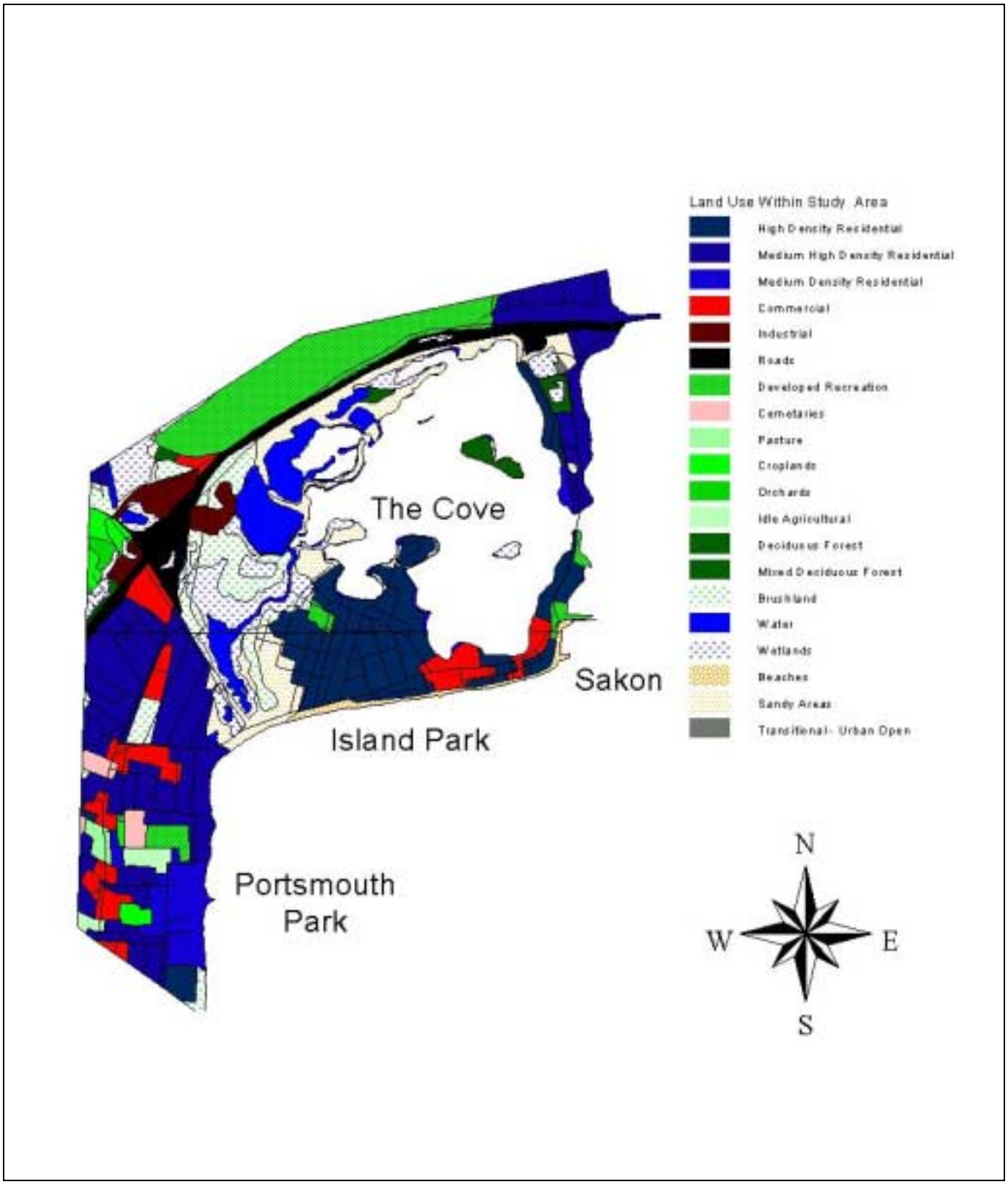
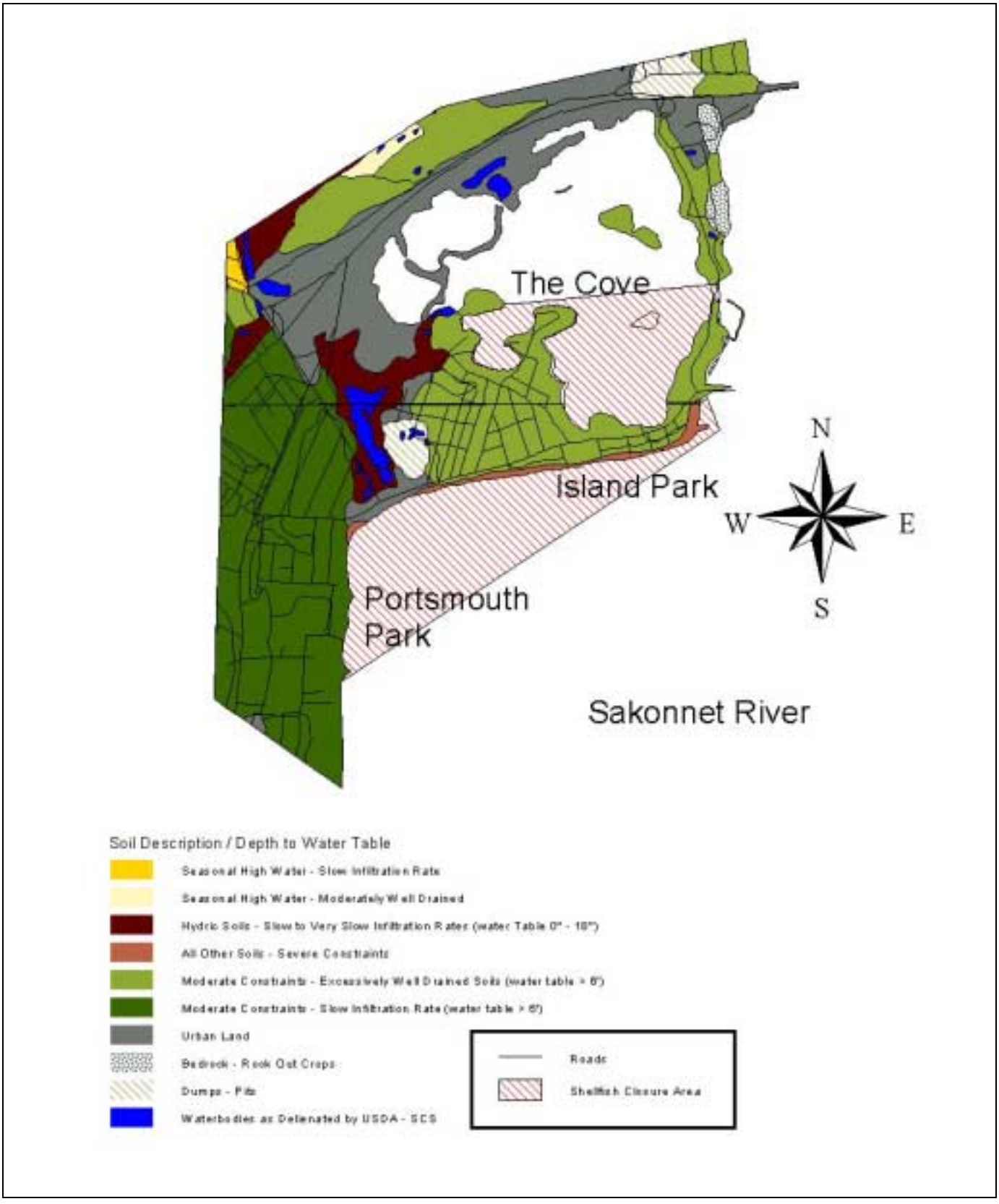


Figure 5 – Portsmouth Soils Map



4.3 IMPACTS OF SEPTIC SYSTEMS

The development of the beachfront communities in Portsmouth Park and Island Park pre-dates the inception of current ISDS regulations. Thus, because of under-sized lots, conventional septic system design parameters are unattainable in many cases. In addition, cottages were initially constructed for summer use only, and the ISDS installed were probably not designed to handle year round occupancy and year-round flows. Excess flows from an abundance of groundwater springs and heavy rainfall runoff have been addressed by the construction of a storm drainage network that has been added to over the years. The high water table and inability of ISDS to function properly have prompted some homeowners to tap into the storm drains with residential french drains and/or laundry hoses in order to remove pooled water from around homes or to discharge gray water away from the ISDS.

A study conducted by Save The Bay (STB) in 1983 indicated a high rate of failing septic systems in Portsmouth due to unsuitable soil conditions, small lot sizes, overloading due to inadequate design, improper construction and poor maintenance. The septic system failure rate of 8.3% as reported was nearly twice the state average. During the period of 1990-1999, one hundred thirty two (132) septic system complaints were filed with the RIDEM ISDS section (refer to Appendix A).

5 DESCRIPTION OF WATER QUALITY MONITORING ACTIVITIES

5.1 RIDEM SHELLFISH PROGRAM OVERVIEW

RIDEM's Shellfish Water Quality Monitoring Program (Shellfish Program) operates within the State of Rhode Island's agreement with the U.S. Food and Drug Administration National Shellfish Sanitation Program (NSSP). The primary objective of the NSSP is to prevent the consumption of contaminated shellfish. In accordance with NSSP requirements, the RI Shellfish Program employs routine ambient water quality sampling of growing area (overlying) waters, and conducts regularly scheduled shoreline sanitary surveys to identifiy potential sources of pollution.

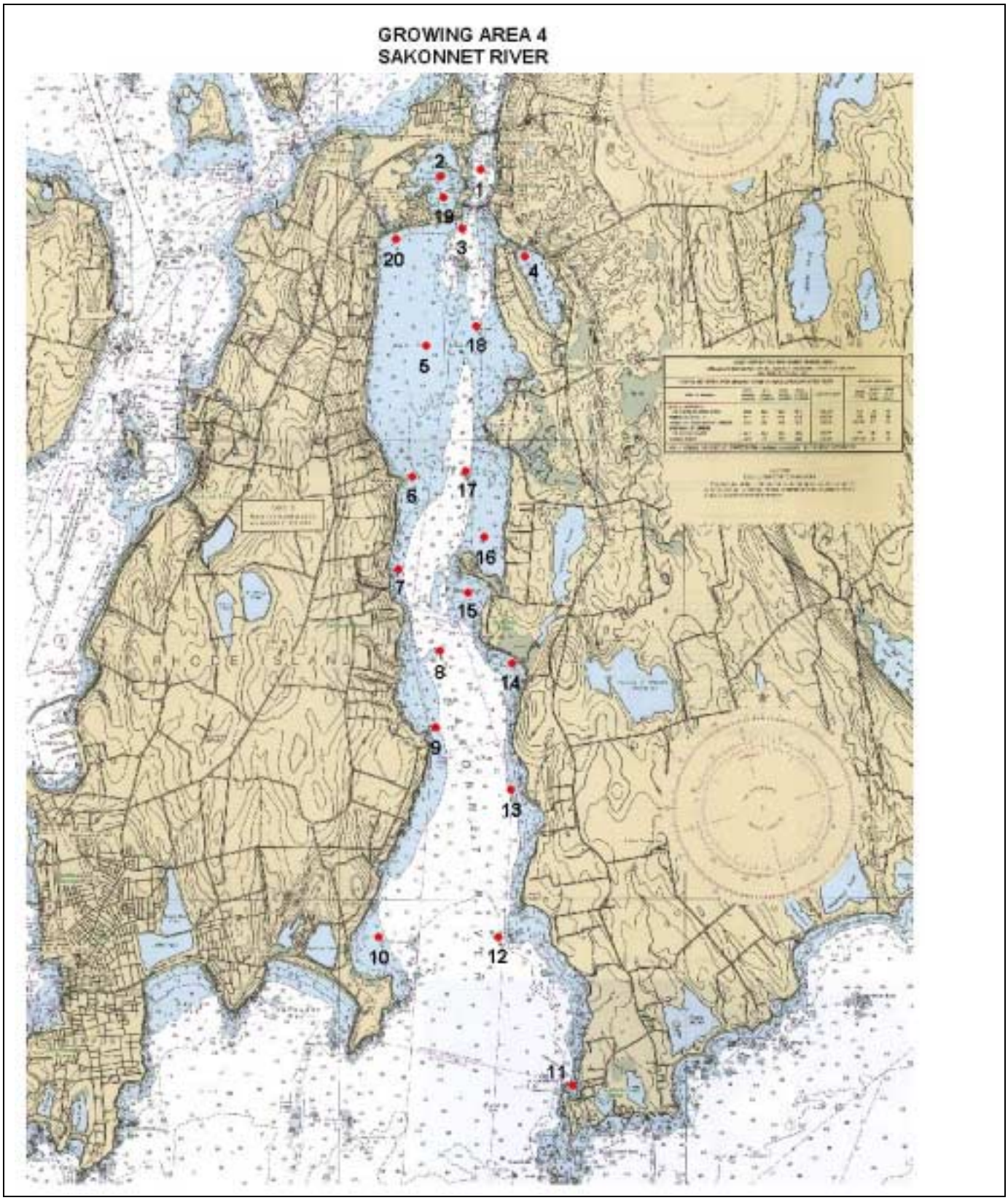
5.2 RIDEM SHELLFISH PROGRAM SHORELINE SURVEY DATA

Shoreline surveys are conducted to identify and quantify all actual and potential sources of pollution which may directly or indirectly affect a growing area, and as a result, render shellfish harvested from that area as unsafe for human consumption. Sewage odors and any other evidence of human waste contamination are documented and samples are taken from all creeks, streams, ground water seeps and discharge pipes/culverts found flowing during the sanitary survey. The samples are analyzed at the RI Department of Health Laboratory for fecal coliform concentrations. An annual analysis of newly acquired data is used to determine whether the designated classification of the area complies with the requirements of the NSSP, and whether any classification changes are necessary.

5.2.1 RIDEM SPRING 1987 UPPER SAKONNET RIVER SHORELINE SURVEY

RIDEM Shellfish Program staff conducted a routine shoreline and follow-up survey of the Upper Sakonnet River on July 28, 29 and August 6, 1987. The study area included the beach front from Portsmouth Park to Island Park, continuing north to the Sakonnet Bridge and the southern half of Blue Bill Cove ("The Cove") in Portsmouth; as well as the shoreline from the Sakonnet Bridge south to the mouth of the Quaket River and Nannaquaket Pond in Tiverton (Figure 6). The weather on all survey days was sunny and clear and no significant rainfall occurred during the two weeks prior to the survey.

Figure 6 – Shellfish Program Water Quality Monitoring Stations in the Sakonnet River



Twenty-one (21) culverts and pipes, and two (2) creeks were located throughout the area (Figure 7) during the survey, and samples of all discharges were collected and analyzed for total and fecal coliform bacteria. The report notes that several of the pipes were submerged, necessitating a sampling of the surrounding water directly at the mouth of the pipe. Five (5) samples were taken along the Portsmouth Park shoreline (#11, #12, #13, #14, and #15), and four (4) samples were taken in The Cove (#10, #41, #71, and #72). A routine ambient water quality sampling location (#3, in the Sakonnet River north of Gould Island) was also sampled.

Three (3) problem discharges were identified in the Portsmouth Park Area (#13, #14, #15) and two (2) were located in The Cove (#10, #72) (Table 1).

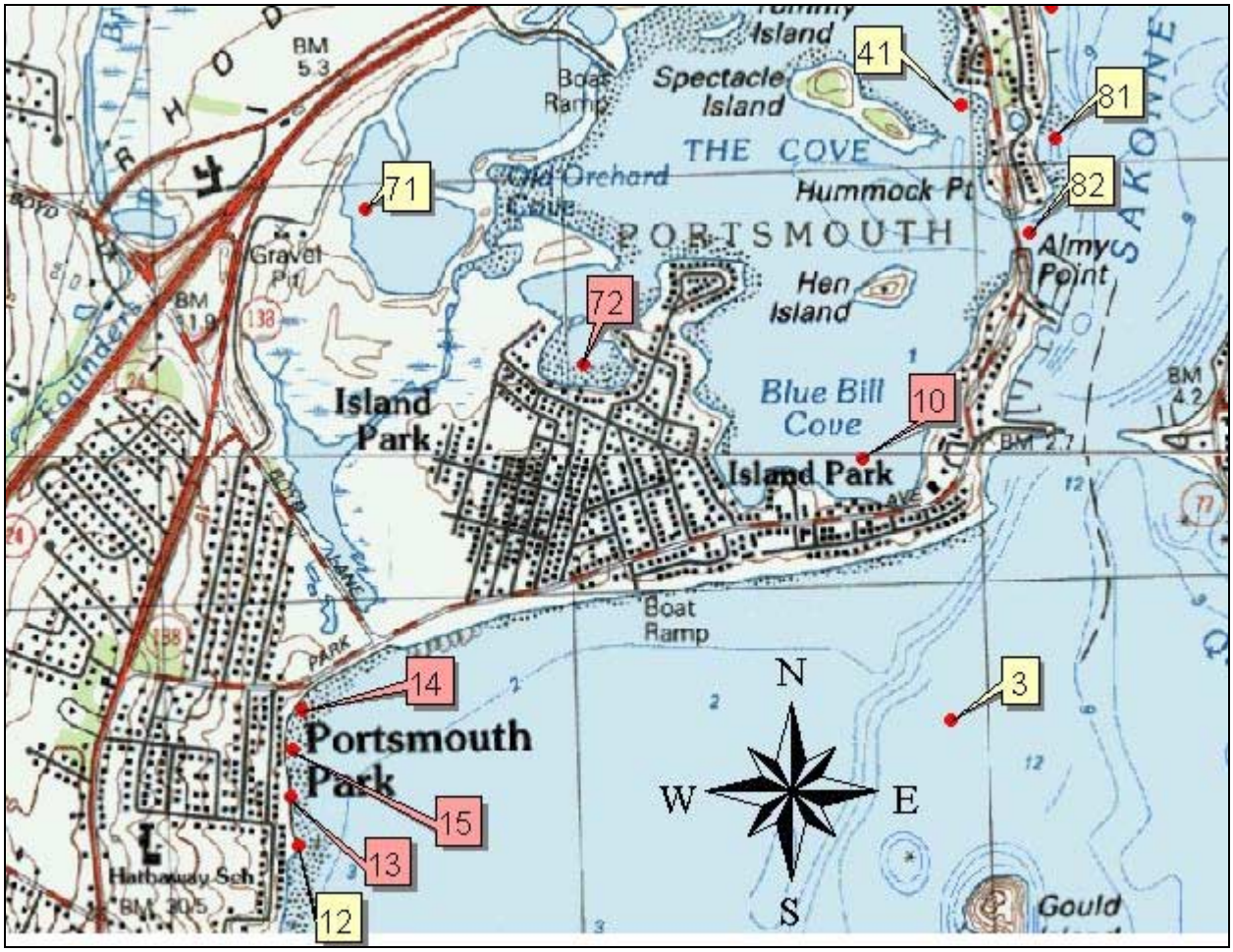
Table 1- Problem Discharges in the Sakonnet River (Portsmouth Park) and Island Park - The Cove. RIDEM Shellfish Program Upper Sakonnet River Shoreline Survey - July 1987.

Location	Station #	Sample Location Description	Total coliform MPN / 100 ml	Fecal coliform MPN / 100 ml
Portsmouth Park	13	Discharge pipe: 62 Aquidneck Road	>23,000*	>23,000*
Portsmouth Park	14	Discharge pipe: 48 Aquidneck Road	>23,000*	9,300
Portsmouth Park	15	Stormdrain discharge culvert	>23,000*	>23,000*
Island Park/The Cove	10	Discharge pipe: 636 Park Avenue	>23,000*	>23,000*
Island Park/The Cove	72	Discharge pipe: 197 Cedar Avenue	>23,000*	>23,000*

- Did not take dilutions far enough to enumerate beyond 23,000 MPN/100 ml.

Four out of the five pipes were discharging flow containing fecal coliform counts of 23,000 MPN/100 ml. The additional pipe was discharging a fecal coliform count of 9,300 MPN/100 ml. The follow-up investigation of the five problem discharges identified in the Portsmouth Park/Island Park area took place on August 6, 1987, and involved both testing of ISDS's with dye and interviews with residents. Discharge pipes #13, #14 and #72 tested positive with dye tracing from nearby homes. Discharge pipe #10 resulted in a negative dye test, however the report suggested that the slow seepage rate from this pipe may necessitate a longer period of inspection than what was allotted for this survey. Sample #15 was taken from the outflow of a stormwater drainage culvert. Faulty septic system and illegal tie-ins were cited as possible sources for the high coliform counts at this location. Station locations are shown on Figure 7.

Figure 7 – 1987 Shoreline Survey Problem Discharge Sample Locations



The July 1987 shoreline survey report recommended that the area adjacent to the Island Park Plat and west to the Portsmouth Park Plat should be closed indefinitely to shellfishing until the sources of bacterial input to the area were identified and mitigated. The report also recommended mitigation of the verified discharges (through dye testing and admissions by owners). The high total and fecal coliform inputs and the rapid flow rate present in the storm drain system of the Portsmouth Park Plat suggested a possible upland contamination problem that warranted further investigation.

Their 1987 report also identified the new closure lines – which is now the current closure delineation. The report recommended a comprehensive dye study of the entire area in order to locate the sources of fecal coliform into the storm drainage network.

On November 5, 1987, RIDEM Shellfish Program conducted a follow-up visit to further investigate the Portsmouth Park stormwater culvert (sample #15) and to survey the eastern-most end of Morningside Lane, which is the westernmost point of the new closure line. The first uphill drop inlet (from the shore discharge location into the Sakonnet River) located on Aquidneck Road was inspected. This location is approximately 150-feet from the point of discharge to the river. The inspection of the drop inlet revealed four pipes, all of which were flowing moderately to rapidly. The report noted the lack of rainfall during the previous seven days, therefore pipes should have been dry or had very low flows. A strong sewage smell was also reported. Samples were taken from each of the three incoming storm drain pipes and from the fourth incoming pipe, a three to four inch diameter black plastic pipe from an unknown source. A review of the Portsmouth Park storm drain plans did not indicate the presence of this pipe, indicating that it represented an illegal discharge into the system.

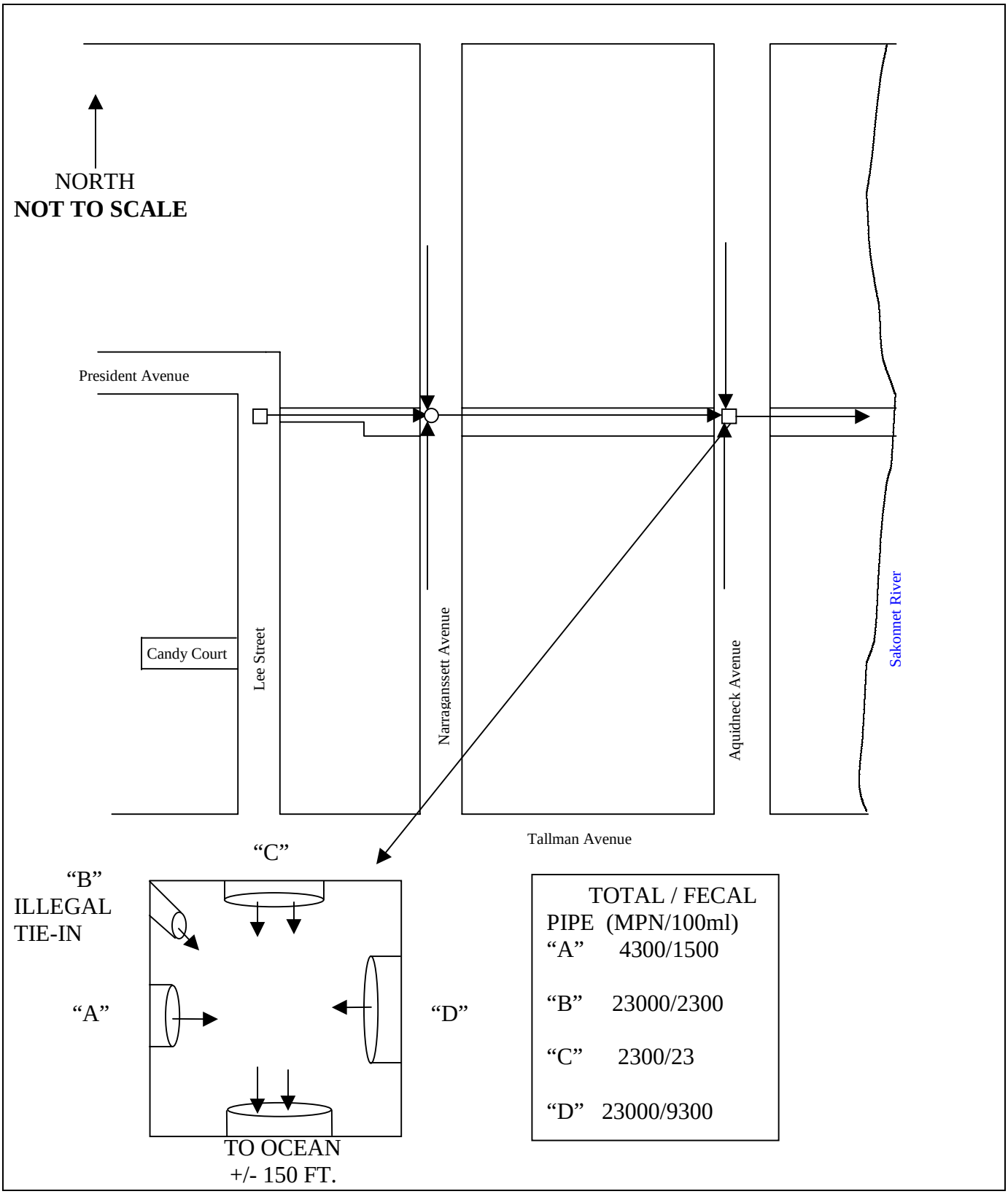
The total and fecal coliform sample results are shown in Table 2, and a view of the pipes is shown in Figure 8. The three incoming stormdrain pipes were discharging fecal coliform concentrations of 1,500, 23 and 9,300 MPN/100 ml. The unknown tie-in pipe contained a fecal coliform concentration of 2,300 MPN/100 ml.

Table 2. Sample results from Aquidneck Road Drop Inlet Survey, November 5, 1987. RIDEM Shellfish Program.

Pipe Label	Aquidneck Road drop inlet pipe locations	Total coliform MPN/100 ml	Fecal coliform MPN/100 ml
A	Incoming stormdrain pipe from the south	4,300	1,500
C	Incoming stormdrain pipe from the west	2,300	23
D	Incoming stormdrain pipe from the north	>23,000*	9,300
B	Illegal tie-in from the south-west	>23,000*	2,300

* Did not take dilutions far enough to enumerate beyond 23,000 MPN/100 ml.

Figure 8 – Portsmouth Park Storm Drain



The subsequent investigation of another drop inlet on Aquidneck Road, located south of the one described above, revealed another suspected illegal pipe discharging into the stormdrain system. This pipe was also flowing and smelled of sewage, however a sample of this discharge was not taken due to a lack of sample bottles. A resident indicated that a persistent sewage odor emanates from the drop inlet.

Reconnaissance of the shoreline along the eastern-most end of Morningside Lane revealed a twenty-four inch stormwater culvert discharging a moderate flow. No sewage smell was detected, however algae growth was noted within the pipe. It was recommended that future sampling of this discharge would be justified considering that this culvert is located directly on the shellfishing closure line.

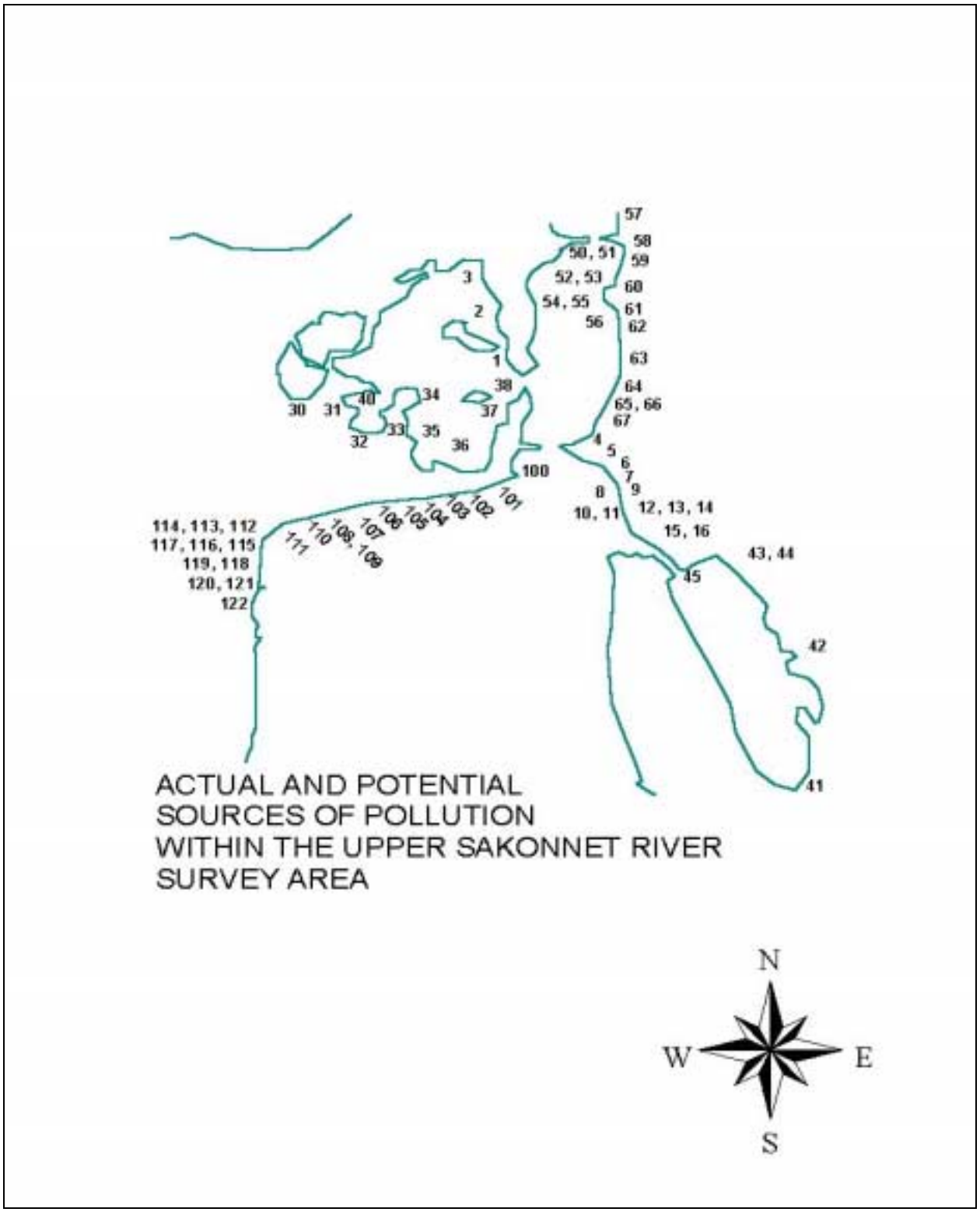
A Shellfish Program report dated May 10, 1988 summarized further investigations of illegal tie-ins into the Aquidneck Road storm sewers. The area was revisited four times subsequent to the November 1987 visit and twenty eight (28) samples were taken, twenty-one (21) of which represented the storm sewer, associated pipes and the outfall into the Sakonnet River. Additionally, two (2) samples were taken from Tallman Avenue, three (3) samples from Park Avenue, and one each at the storm drain outfalls of Morningside Lane and Child Street. Total and fecal coliform densities found in flows from "apparently unapproved" tie-ins to the Aquidneck Road storm sewer system were low. However, samples taken directly from storm sewer did have high counts (samples #18, #22, #12, #21). This study was unsuccessful at locating a source of the high coliform counts, however the report does note discussions with area residents that indicate that the Portsmouth Park area is chronically wet. This report noted that two systems were currently under mitigation for violation of discharging septic overflow directly to the Sakonnet River shoreline.

The Shellfish Program concluded that the fecal inputs to the storm sewers were from non-point sources associated with the high housing density, and the existence of old, malfunctioning and undersized septic systems. Furthermore, contaminated discharges from the storm sewers posed a threat to the management of the area for safe consumption of shellfish. As a result, the two areas were permanently closed to shellfishing as of May 1988.

5.2.2 RIDEM SPRING 1990 SHORELINE SURVEY

A routine shoreline survey was conducted from May 2, 1990 to May 18, 1990. Precipitation events occurred on four (4) out of seven (7) days of the survey resulting in a rainfall totalling approximately 1.98". Average rainfall for the month of May in the three previous years was approximately 3.4". With 1.98" of rainfall over a four day period being a significant portion of the total monthly average, this survey could be considered as typical of a wet weather survey. There were eleven (11) sampling stations in the Portsmouth Park area (Station #114, 113, 112, 117, 116, 115, 119, 118, 120, 121, 122) and twelve (12) sampling stations along the shoreline from Portsmouth Park to Island Park (Station #111, 110, 109, 108, 107, 106, 105, 104, 103, 102, 101, 100). Thirteen (13) stations were located in The Cove (Station # 1, 2, 3, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40) as shown in Figure 9.

Figure 9 – Spring 1990 Actual and Potential Sources of Pollution



Four discharges were identified as contributing elevated total and fecal coliform counts to the Upper Sakonnet River. Sample # 118 was taken from a six-inch cast iron pipe at the base of the seawall at 62 Aquidneck Avenue in Portsmouth Park. A follow-up investigation was recommended to locate the origin of the pipe and to perform a dye test. It was suspected to be an antiquated septic system or overflow from a graywater discharge. Four samples (# 30, # 40, # 36, and # 37) were taken from the Cove, and were identified as possibly failing ISDS. Because several of these stations were located on salt marshes and in areas with extremely saturated soils, future dye tests were recommended.

Table 3. Spring 1990 Upper Sakonnet River shoreline survey results of problem discharges In Portsmouth Park.

Station #	Description & Location	Total Coliform MPN/100 ml	Fecal Coliform MPN/100 ml
118	6-inch cast iron pipe at base of seawall on south side of property located at 62 Aquidneck Ave.	9,300	4,300
106	12-inch storm drain located opposite pole #403 Park Ave.	43,000	15,000
107	12-inch concrete drain pipe located at intersection of Mason Ave. and Park Ave.	93,000	4,300
111	24-inch concrete drainpipe with evidence of gray water discharge located at pole #420, Park Ave.	230,000	230,000

This report additionally recommended investigating the uplands for contributions of contamination to the storm drains and also recommended adding two additional water quality monitoring stations: one within the southern section of The Cove and one within the closed area of the northwest section of the river.

5.2.3 SPRING 2000 ISLAND PARK SHORELINE SURVEY

A routine shoreline survey was conducted on April 14, 2000 of the closed portion of "The Cove". This survey was conducted during dry weather. Seven of the eight stations inspected were not flowing at the time of the survey. The one source sampled was a groundwater seep within the vicinity of a house located on Point Street (refer to Figure 10). The seep had an apparent septic odor, and fecal coliform results for this source were high (23,000 MPN/100 ml). The source is most likely attributed to a failing septic system.

Figure 10 – Spring 2000 Shoreline Survey Station Locations

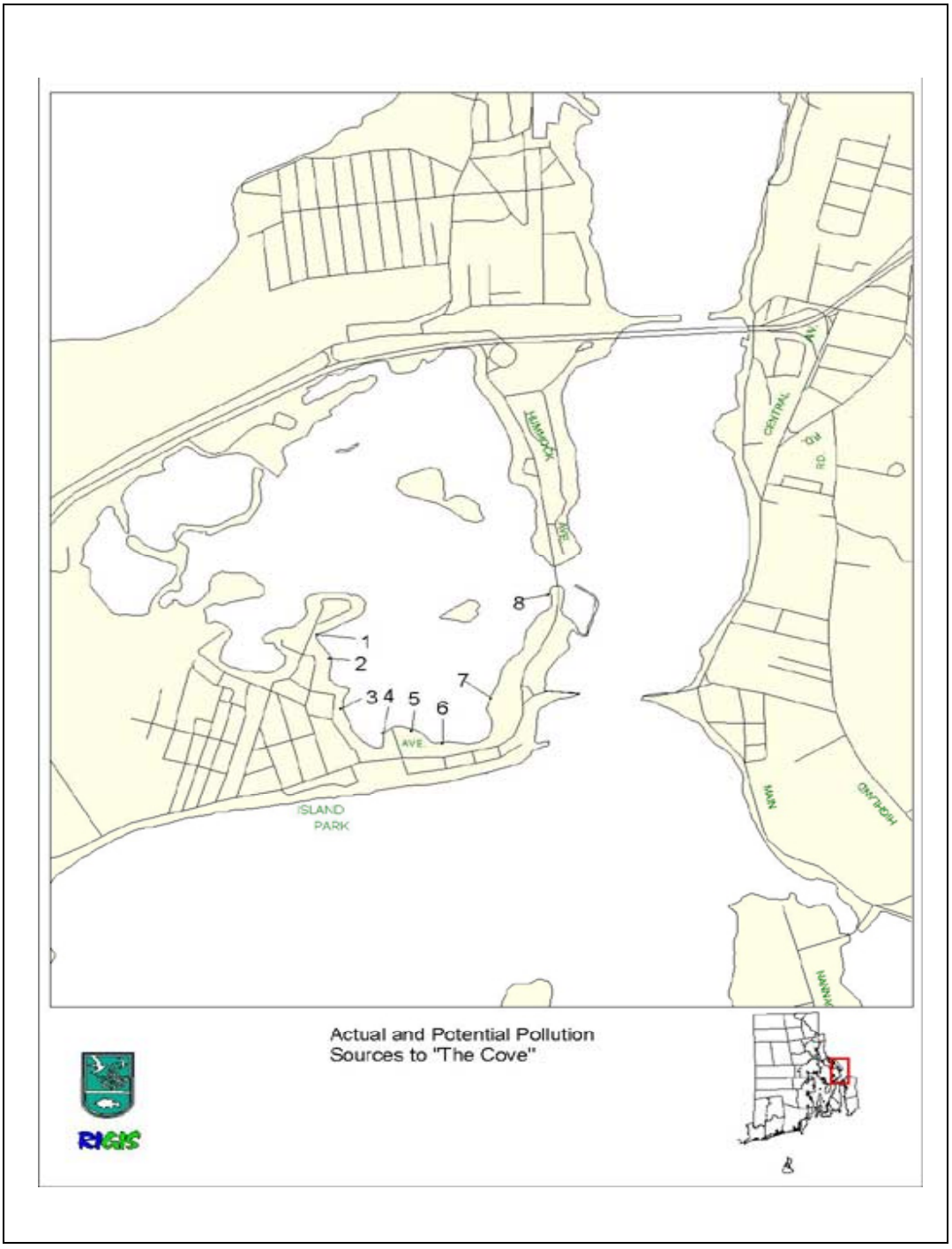


Table 4. Spring 2000 Island Park shoreline survey results of problem discharges

Station #	Description & Location	Total Coliform MPN/100 ml	Fecal Coliform MPN/100 ml
5	Seep at 606 Point Street	>23,000*	>23,000*

*Did not take dilutions far enough to enumerate beyond 23,000 MPN/100 ml.

5.3 RIDEM SHELLFISH PROGRAM AMBIENT WATER QUALITY SAMPLING

Approved growing areas are sampled six times per year. Conditionally approved and conditional/seasonally approved areas require monthly sampling when they are open for harvesting, and seasonally approved areas are sampled three times per year when they are open for harvesting. There are no NSSP monitoring requirements for stations that are classified as "prohibited". Generally, stations that are located in prohibited zones located close to approved growing areas are also sampled six times per year based on the NSSP's systematically random sampling proceedures. As such, routine ambient water quality sampling at the Sakonnet (Portsmouth Park) and Island Park-The Cove shellfishing area is conducted approximately six times per year.

There are presently four (4) routine ambient water quality monitoring stations (stations 2,3,19,20) in the impaired Sakonnet River and Cove areas (Figure 6 on page 14)**.** The Shellfish Program compiles an annual report that summarizes program activities and makes recommendations for changing the classification of an area. The Shellfish Program uses the most current thirty (30) sample results to calculate the geometric mean and 90th percentile values and compares the data statistically to the stated criteria.

The closure of shellfish areas to harvesting is not solely based on the ambient water quality data calculations. In accordance with the NSSP, a shellfish growing area shall be classified as "Prohibited" if no current sanitary survey has been performed or if a sanitary survey or other monitoring program data indicates that fecal material may reach the area in excessive concentrations. If it has been determined that there is a good potential for harvested shellfish to be contaminated due to the nature of an upland source, then a growing area is closed.

Total and fecal coliform data from the offshore water sampling stations sampled by the RIDEM Shellfish Program have not historically exceeded the Class SA water quality criteria for fecal coliform. However, The Portsmouth Park area of the Sakonnet River and the Island Park area of The Cove have been designated as "prohibited" and are closed for shellfishing. This is due to the shoreline survey results, the storm drain sampling data, the presence of old and failing ISDS and the associated potential human public health threat posed by shellfish consumption in an area containing potentially elevated contaminant sources discharging directly into the River.

5.3.1 RIDEM SHELLFISH PROGRAM ROUTINE AMBIENT WATER QUALITY SURVEY

In 1998, two additional sampling stations were added to the routine ambient water quality monitoring program. Station #19 is located within the southern portion of The Cove and Station #20 is located west of existing Station #3 (Refer to Figure 6, Page 14). Both are located within the impaired/permanently-closed areas. A total of fourteen samples of these new stations have been collected since 1998. As this sampling is done on a random sampling schedule, the following results are representative of all weather conditions. Of the fourteen new station samples, six (6) were collected during dry weather and eight (8) were collected during wet weather.

Table 5. RIDEM Shellfish Program Growing Area Monitoring Results (through 2000) for Growing Area 4 (as reported 9/9/2000)

Station No.	Location	Number of Samples		Fecal Coliform Geo. Mean MPN / 100 ml		% > 49 MPN / 100 ml		90th percentile (<49)	
		DRY	WET	DRY	WET	DRY	WET	DRY	WET
2	The Cove	7	10	2.6	4.3	0.00	0.00	4.0	11.0
19	The Cove	6	8	4.8	4.0	16.67	0.00	32.3	12.7
3	Sakonnet R.	7	10	3.3	5.9	0.00	0.00	6.8	20.9
20	Sakonnet R.	6	8	4.6	4.0	0.00	0.00	21.6	20.7

"Geo. Mean" is the geometric mean of the sample results. "N" is the number of sample results included in the calculation of the geometric mean.

The "% > crit 49" is the percentage of values that are greater than 49 MPN/100 ml.

The "90th percentile" determination is the calculated value whereby 90% of all values are less than 49.

5.4 RIDEM DIVISION OF WATER RESOURCES EPA RESEARCH GRANT

A 1992 EPA funded project entitled " Development and Implementation of Methods to identify Fecal Coliform Contamination of Storm Sewers"; laid the ground work for the 1995 EPA funded project entitled "Development of Remediation Methodology to Mitigate Sewage Contamination of Community Watersheds".

The two studies involved four key components: 1) a pollution questionnaire which was sent to homeowners, 2) stormdrain mapping and monitoring, 3) ISDS Inspections and dye investigations using a pollution indexing method to identify suspect septic systems, and 4) an assessment of new/alternative sewage treatment technologies. A description of each activity is provided below.

5.4.1 POLLUTION QUESTIONAIRE

In March and April of 1994 RIDEM produced a questionnaire to be sent to residents of the Portsmouth Park / Island Park neighborhoods. The objective of the pollution questionnaire was to provide a mechanism for residential participation in the identification process. The questions were simple and direct and the answers were multiple choice. The five hundred-fifty four (554) acre Portsmouth/Island Park study area was divided into fifty four (54) GIS grid maps of ten and three tenths (10.3) acres. These grids were split evenly into twenty-seven (27) maps of each sub-area (Portsmouth Park / Island Park). Seventeen maps of each sub-area were polled with the questionnaire. Thus 63% of each area was polled. In cooperation with Save The Bay, the Homeowner's Septic System Fact Sheet was developed and sent to homeowners along with the questionnaire as a public education medium.

A total of five hundred fourteen (514) questionnaires were mailed of which 46 were returned with incorrect addresses and one hundred thirty two (132) were returned completed. Thus the response of delivered questionnaires was 29%. The results of the questionnaire are as follows:

1. Geology: ***What neighborhood do you live in?***

43% of the respondents were from Island Park. Their systems are in well-drained sandy soil. The other 57% were from Portsmouth Park, which has a slow draining soil with an impervious layer of shale ledge within 2-5 feet of the surface.

2. Shoreline proximity: ***How close is your house to the water?***

An average of 46% of the people lived four or more houses back from the water. Island Park as expected with its cove and peninsulas had 10% more respondents on the waters edge.

3. Occupancy: ***How many people live in your house?***

51% of the study area residents reported between one and two (1-2) people living in the home. 40% had between three to five (3-5) residents and 4% had six to eight people (6-8) on average.

4. Water using devices: ***Circle all that you use in your house.***

On average: 84% of the residents used a clothes washer. 39% used a dishwasher. Only 3% had a garbage disposal.

17% more homes used a sump pump in Portsmouth Park than in Island Park. This agrees with the soil type.

5. Age of House: ***How old is your house?***

On average 90% of the homes were built before 1975. 4% were between ten to nineteen (10-19) years old and 2% were less than ten (10) years old.

6. Age of septic system: ***How old is your septic system?***

59% of the residents in Portsmouth Park had 16% more twenty plus (20+) year old systems than Island park. The average ages were 16% of the systems were between ten to nineteen (10-19) years old, 7% were between five to nine (5-9) years old, and 15% were new systems less than five (5) years old.

7. Type of septic system: ***What type of septic system do you have?***

22% of Island Park are using only cesspools as compared to 5% in Portsmouth Park. 14% on average do not know what type of system they have.

8. Frequency of local septic system failure: ***Do you smell sewage odors in or near your yard?***

5% more people in Portsmouth Park vs. Island Park have smelled a failed septic system. On average, 28% have detected an odor problem.

9. Septic pumping frequency: ***How often do you pump out your cesspool/septic tank****?*

On average 15% of the respondents never pumped their systems compared to 18% that pumped once or twice per year. Portsmouth Park respondents pumped every three to five (3-5) years 16% more than Island Park.

10. Septic repairs performed: ***Has your septic system been repaired or replaced?***

38% and 28% of Island Park and Portsmouth Park respectively reported having improved their systems. On average 6% did not know. 48% on average are original systems, as compared with 52%, from question six, being more than twenty (20) years old. Thus it appears that about 50% of the systems date before 1975.

11. Septic system inspection interest: ***Would you like a free septic system inspection?***

60% of the people did not want to have their systems inspected.

12. Town septic management interest: ***Do you think the town should have a program to provide septic system maintenance?***

43% of the people were undecided about "Waste Water Management District" establishment. The yes and no opinions were equally divided at about 26%. If the undecided population were sold on the idea of establishing a WWMD a town ordinance would have a good chance for passing.

13. French drain connection: ***Do you have French Drains tied into the stormwater pipes?***

At least 9% of Portsmouth Park residents were connected to storm drains. No one in Island Park reported a connection. 21% of both areas did not know.

14. Direct connection inquiry: ***Do any of your house drains connect to the stormwater pipes****?*

Nobody in the total area reported having "toilet water" connected to the stormwater pipes. Twice the percentage of people in Portsmouth Park vs. Island Park had other types of water sources connected at 4% and 2% respectively. About 75% of both areas denied being connected at all.

For a complete list of multiple-choice answers and the results for each question, refer to Appendix B.

5.4.2 STORM DRAIN MAPPING AND MONITORING

RIDEM has been dealing with bacterial contamination within storm drainage collection systems for many years. RIDEM's traditional approach to this problem is to collect water samples within drainage systems to help identify the source of the contamination and then perform dye tests of adjacent properties to identify the source of the contamination. If the source is identified as a failing septic system, RIDEM would require the owner to correct the problem by repairing the septic system or connecting their property to a public sewerage system. Unfortunately, this approach does not work for an area such as Portsmouth Park /Island Park where the contamination in the drainage system is widespread, potentially dozens of properties are involved, and no public sewerage system is available.

Between December 1993 and March 1998 a method of identifying, locating, mapping and monitoring of storm drains and suspected sources of fecal contamination was developed. The intent of these studies was to develop techniques to (1) identify the source or sources of bacterial contamination within a collection system where the contamination is widespread, and (2) identify remedial measures that can be taken to correct these problem sources. The intent of the studies was research. RIDEM recognized that the success of these studies depended on the cooperation of the property owners and town officials in inspecting the properties and obtaining information about the problems in the area. Since RIDEM would be actively asking for their cooperation and assistance, RIDEM decided that any information that was collected form these studies would not be used in enforcement actions against the owners.

Sampling was conducted on a variety of potential sources and sites, including in line, end of pipe and various shoreline pipe outfalls. A RIGIS grid number system was generated for the mapping of the study area (Figure 11). Individual field survey maps of each grid were produced at a map scale of 1inch = 100 feet. These maps contain map/lot numbers and boundaries from tax assessor maps and were used in the field to organize field data into manageable units. The sources identified and sampled in the field such as catch basins, culverts and stormdrain out-fall pipes were later georeferenced in GIS.

Each sample site was assigned a unique number. For multiple pipes at one location, such as a catch basin with many contributing pipes, the sample pipes were labeled clockwise by letter. The sample site numbers were associated with a RIGIS grid number. Flow direction and routing of the stormdrain network was determined. Pollution source locations, including catch basins, culverts and storm-drain out-fall pipes were mapped and incorporated in GIS. General geological characteristics were included such as spring locations.

Table 6 is a compilation of all the sampling data collected during the study period. Sampling was done during both dry and wet weather conditions. The Portsmouth Park neighborhood contains a network of old drainpipes originally designed and installed to lower the water on this hillside neighborhood. Portsmouth Park has six concrete stormdrains that discharge on the shoreline and one that is buried by sand off Boyd's Lane (Figure 12). Some of these pipes flow continuously, even in dry weather. The stormdrains at Aquidneck Ave. and Morningside Lane flowed throughout the year with minimal dry weather rates of 4 gallons per minute and 0.2 gallons per minute respectively. The "Development of an Investigative Method to Identify Sources of Fecal Coliform Contamination within a Stormdrain Collection System" report noted that the Aquidneck storm drain flow smelled strongly of sewage. Discussions with residents provided information about the history of the water flow in the area. The report also noted that the land downhill from Carter's Seafood was the site of a seasonal wetland and

pond prior to the development of condominiums. French drains were installed to intercept groundwater and lower the water table to allow for the construction of septic systems. The source of the Morningside Lane flow was traced to be under a cul-de-sac at the top of the hill behind the Citizens Bank property.

The study found no sewage odors emanating from the Child Street (Portsmouth Park) storm drain during dry weather and found it experienced infrequent seasonal flows, indicating it was an unlikely dry weather source of fecal coliform contamination. However, during rain events, the flow conveyed high densities of fecal coliform in run off that originates from East Main Road.

The draft report, "Development of Remediation Methodology to Mitigate Sewage Contamination of Portsmouth Park & Island Park, Portsmouth, Rhode Island", concluded that the Portsmouth Park storm drainage network discharges sewage-contaminated groundwater directly into the Sakonnet River. This study also concluded that conventional Rhode Island septic system designs would fail on many of these sites due to the seasonally high groundwater table in Portsmouth Park and the insufficient retention time in the quickly drained soils of Island Park.

Figure 11 – Study Area Grid Index

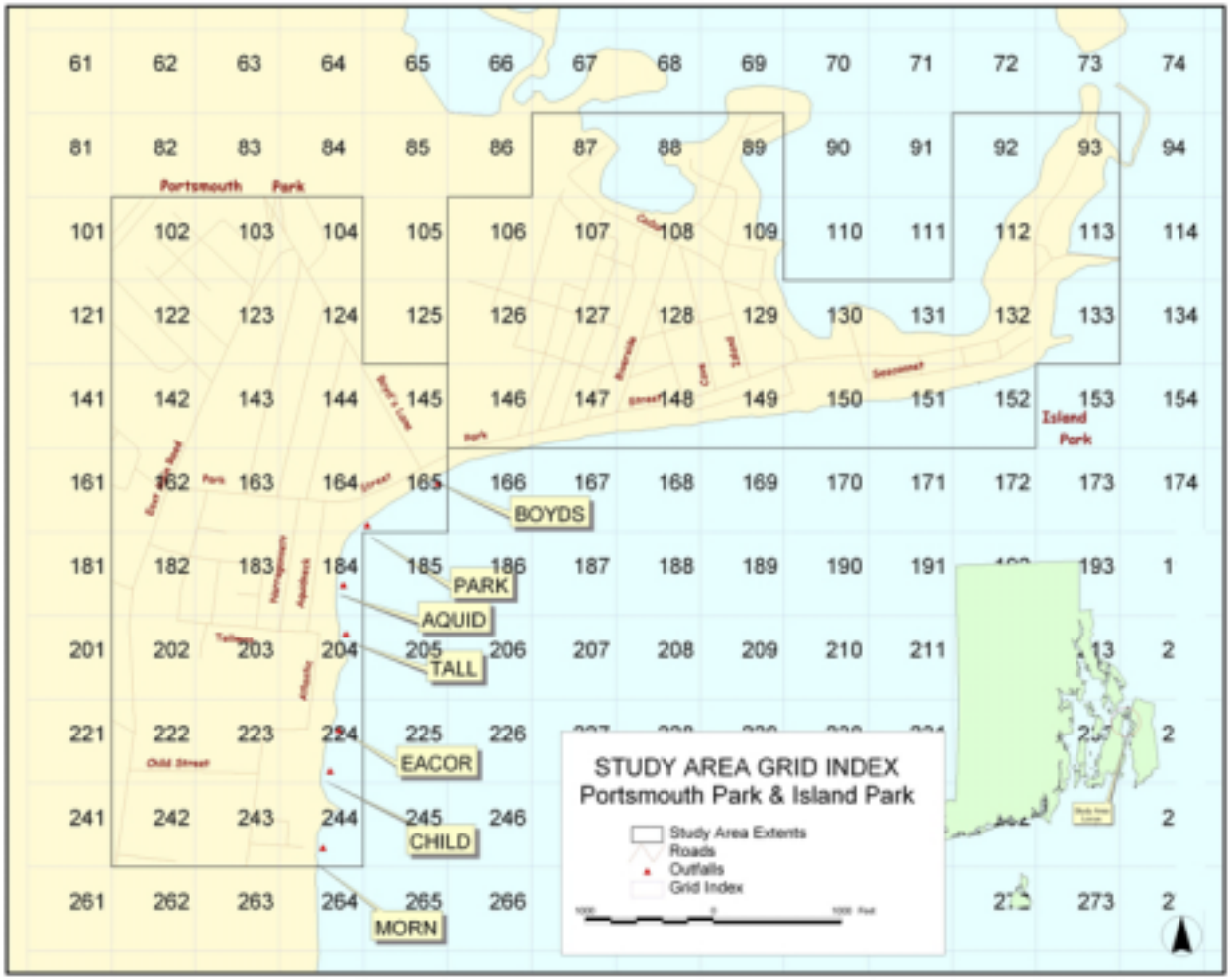


Figure 12 – Location of Portsmouth Park Stormwater Outfalls

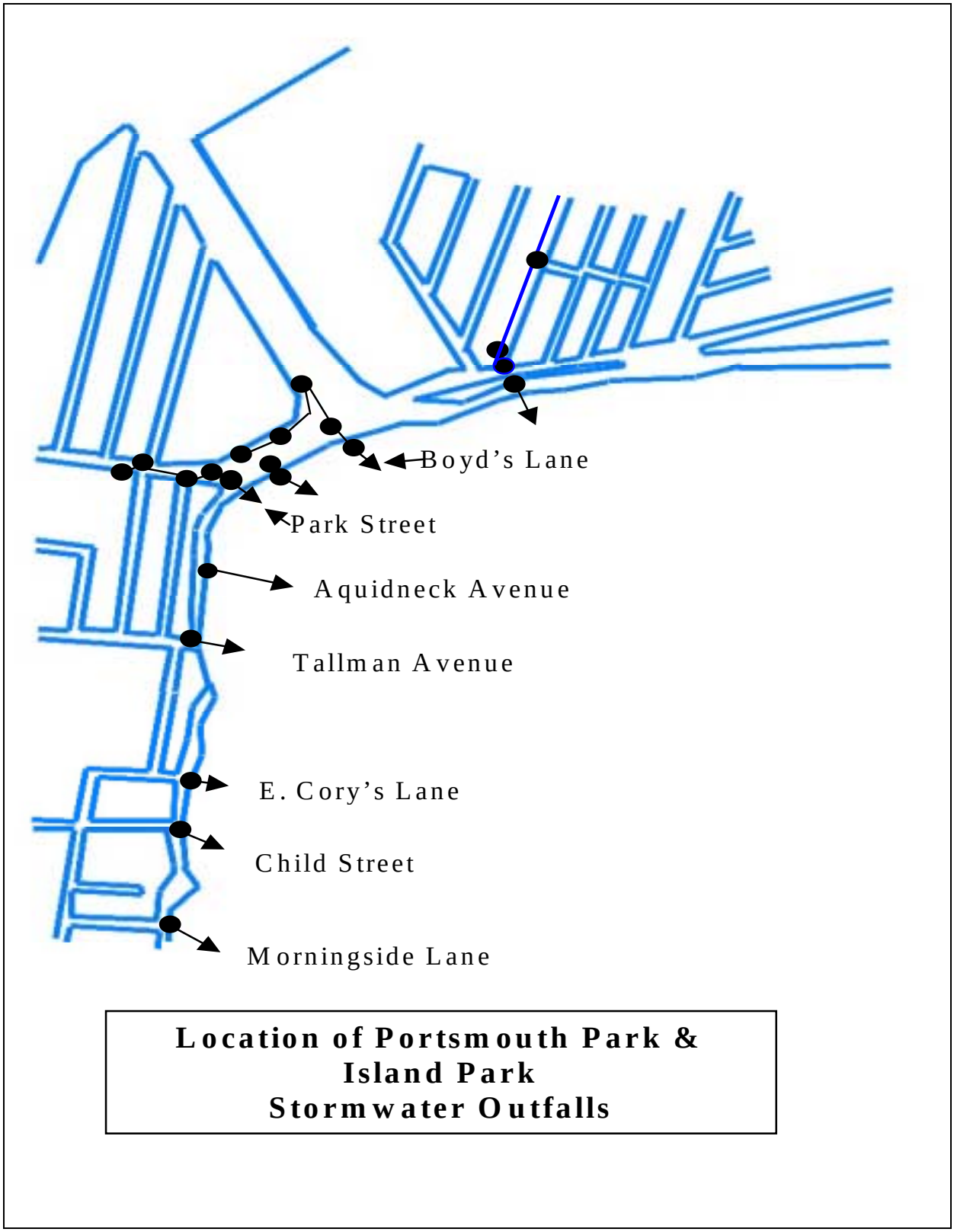


Figure 13 – Portsmouth Park Sampling Locations

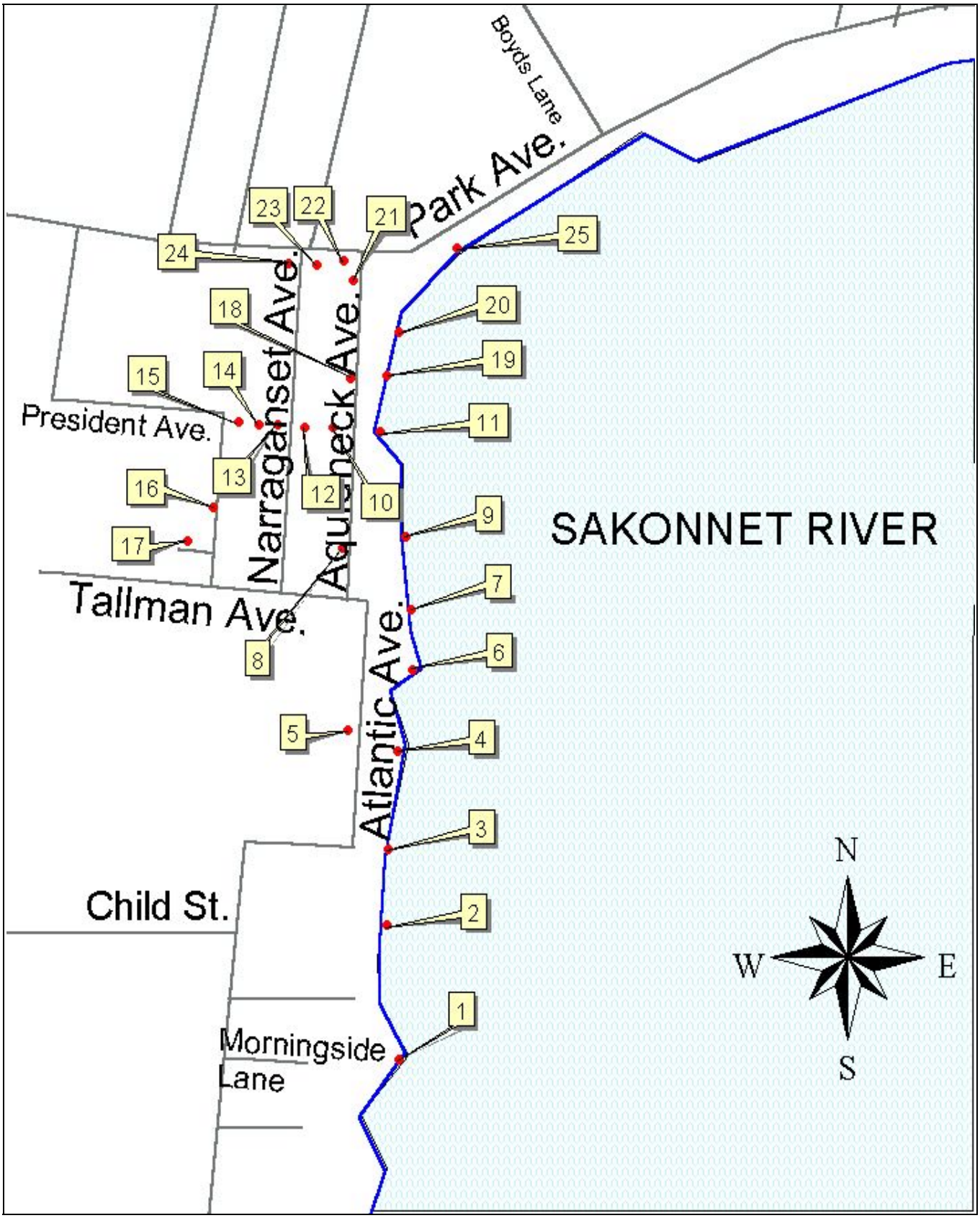


Table 6. Portsmouth Park Total and Fecal Coliform Results

Station Id Number	Date	Description	Type	Total Coliform (MPN/100ml)	Fecal Coliform (MPN/100 ml)	Weather Conditions	Flow Rate (GALS/MIN.)
1	5/17/94	Morningside Outfall	Outfall	9,300	1,500	Lt. Rain	25
	5/24/94			16	9	Dry	25
	6/14/94			15,000	9,300	Wet	225
2	5/17/94	Child Street	Outfall	9,300	230	Lt. Rain	250
	6/14/94			43,000	43,000	Wet	9000
3	12/22/93	East Cory's Lane	Outfall	150,000	43,000	Dry	No Flow
	5/17/94			2,300	430	Lt. Rain	45
	5/24/94			4,300	23	Dry	25
	6/14/94			230,000	23,000	Wet	175
	6/15/94			9,300	230	Dry	12
4	8/21/94	25 Atlantic Ave.	Seawall 4" Pvc	230,000	230,000	Wet	
5	6/15/94	Atlantic Ave.	Catch Basin	43,000	430	Dry	No Flow
6	12/22/93	49 Atlantic Ave.	Seawall Seepage	4,300,000	430,000	Dry	
7	12/22/93	Tallman/ Atl. Ave	Outfall	390	23	Dry	
	5/17/94			93,000	43,000	Lt. Rain	25
	5/24/94			930	23	Dry	0.4
	6/14/94			93,000	9,300	Start Rain	175
	6/14/94			43,000	23,000	End Rain	45
8	5/17/94	77 Aquidneck Ave.	Catch Basin	4,300	390	Lt. Rain	
9	12/22/93	76 Aquidneck Ave.	Seawall 3" Pvc	9	0	Dry	
10	2/8/94	62 Narraganset Ave. (Rear)	French Drain?	43,000	230	Lt. Rain	
	6/22/94	62 Narraganset Ave.	4" Pipe In Basin	43	9	Dry	1.5
	6/22/94		24" Pipe In Basin	9,300	2,100	Dry	18
	6/22/94		8" Pipe In Basin	43,000	43,000	Dry	0.15
	6/22/94		8" Pipe In Basin	750,000	2,100	Dry	5
11	12/22/93	48 Aquidneck Ave.	Outfall	4,300	230	Dry	
	5/17/94			93,000	2,300	Lt. Rain	65
	5/24/94			15,000	9,300	Dry	150
	6/14/94			93,000	23,000	Wet	175
	6/22/94			93,000	43,000	Dry	18

Table 6 - continued

Station Id Number	Date	Description	Type	Total Coliform (MPN/100ml)	Fecal Coliform (MPN/100 ml)	Weather Conditions	Flow Rate (GALS/MIN.)
12	5/31/94	62 Narraganset Ave.	4" Pvc In Catch Basin	15,000	430	Dry	1.5
	5/31/94		MAIN PIPE	430	23	Dry	65
	3/1/94			15,000	93	Dry	
	3/1/94		MAIN PIPE	430	9	Dry	
13	6/22/94	47 Narraganset Ave.	Catch Basin	2,300	150	Dry	No Flow
14	6/22/94	47 Narraganset Ave. Rear	Catch Basin	930	93	Dry	64
15	2/21/94	Lee/President	Catch Basin	15,000	93	Lt. Rain	
	6/22/94	Lee/President Carter's Seafood	Pvc Pipe	4	0	Dry	6.5
	6/22/94	Lee/President	Clay Pipe	43	0	Lt. Rain	1.5
16	3/11/94	81 Lee Avenue	Sump Pump	93	4	Dry	
17	3/11/94	12 Candy Court	Catch Basin	3	3	Lt. Rain	
18	2/8/94	37 Aquidneck Ave.	Pvc Pipe	7	0	Lt. Rain	
	2/21/94	37 Aquidneck Ave.	Cement Pipe	230,000	9,300	Lt. Rain	
19	2/21/94	38 Aquidneck Ave.	Seawall	930,000	430,000	Lt. Rain	
20	2/21/94	34 Aquidneck Ave.	Seawall	4,300,000	1,500,000	Lt. Rain	
21	2/7/94	13 Aquidneck Ave.	Clay Pipe In Drain	28	0	Dry	3
22	2/7/94	106 Park Ave.	Catch Basin	43,000	7,500	Dry	
23	6/22/94	16 Narraganset Ave.	Catch Basin	4,300,000	150	Dry	Stagnant
24	6/22/94	13 Narraganset Ave.	Catch Basin	2,300	430	Dry	Stagnant
25	12/22/93	Park Ave.	Outfall	4,300	430	Dry	
	5/17/94			43,000	43,000	Lt. Rain	55
	6/14/94			150,000	23,000	Start Rain	15
	6/14/94			930,000	150,000	End Rain	40
	6/15/94			1,500,000	200,000	Dry	Drip

5.4.3 POLLUTION INDEXING – THE RHODY

A pollution indexing method, known as the RHODY#, was developed as part of the project as a tool for identifying sources of fecal coliform contamination. Historically in Rhode Island, a percolation test is done as part of the septic system permitting process to determine the ability of a soil to absorb water. The sources of contamination to the shoreline from the study neighborhoods is a community wide problem rather than a single site or a limited number of specific sites causing contamination. This was a study to develop a method to indicate potential failure sites, based on certain existing parameters such as water usage, lot size, and general soil types. Site suitability analysis of individual developed homesites in these densely populated neighborhoods was not economically feasible. The RHODY# was therefore used as an indicator to prioritize sites to be further investigated for potential septic failure. A prioritized

list was developed to divide users into groups ranging from lowest number to highest number, with the highest number an indication of the site having the most potential for failure. The list was utilized to initiate septic system dye test investigations.

In addition to the RHODY#, the Shellfish Program shoreline survey reports were utilized to identify suspected pollution sources. Pipes with accumulations of algae or other deposits were located. Flow rates (in gallons per minute) were estimated by measuring the inside diameter and the depth of the cross sectional flow. Fecal coliform samples were collected during both dry weather and wet weather in hot spot locations.

Upland areas were also investigated for visual evidence of failed septic systems, which included unusually lush or burnt lawn sections. If the survey revealed any surface ponding suspected of sewage origin, or any suspicious excavation, the RIDEM Division of Groundwater and ISDS was contacted.

5.4.3.1 DYE INVESTIGATIONS

Dye tests were performed at locations indicated by the RHODY# as potentially failing. Pre-dissolved Fluorescein dye (Uranine; Acid Yellow 73) was poured into toilets and open septic systems. Where needed, a garden hose was used to increase the dye movement rate across the bio-solids mat of the septic systems. Table 8 shows the relationship between a high Rhody # (25.0) and subsequent positive dye results and a lower RHODY # (<7.0) that indicates a negative or undetected result for evidence of direct shoreline impact.

The overall conclusion of the indexing method is that septic system failures in Portsmouth Park and Island Park are strongly associated with high water use, small lot size and impervious soils. This study also indicated that the loading rate (water use) of an ISDS most likely exceeds the design capacity when installed in densely developed old neighborhoods like Portsmouth Park and Island Park, which contain soils with unsuitable assimilative capability. The on-site wastewater treatment systems operating in Portsmouth Park and Island Park are a mix of old cesspools, conventional septic systems, and modified and repaired systems. Some of the old septic systems consist of buried perforated fifty-five gallon drums. All of these systems can be a source of water pollution if overloaded or if subject to groundwater infiltration.

In Island Park, waterfront lots were discovered to have hidden pipes in the sand and rocks of the cove. Homes set back one or more lots from the shore failed to show any evidence of excessive sewage application rates, presumably due to the rapidly drained soils. It is suspected that plumes of poorly treated sewage are created which discharge pathogens to The Cove.

Table 7. Portsmouth Park and Island Park ISDS Inspections / Dye Investigations

RHODY #	House	Street	Comment	MAX (Maximum annual water usage gals/ day)	SOIL (LAMRA – Leaching Area Max. Rate of Application gals/(sq. ft * day))	SQ FT (Lot Sq. Footage)
25.0	636	Park Avenue	+Dye	169	1.20	1715
17.8	47	Narragansett	N.O.V.	54	0.52	1600
16.4	197	Cedar Avenue	+Dye	54	1.20	837
14.2	13	Narragansett	2nd New Sys	86	0.52	3200
13.3	102	Gormley Avenue	Leak	189	1.20	3250
13.3	37	Aquidneck	+Dye	163	0.52	7200
13.2	81	Aquidneck	French Tye	81	0.52	3600
12.7	71	Aquidneck	+Dye	78	0.52	3600
12.4	4	Atlantic Avenue	+Dye	85	0.52	4000
12.0	44	Gormley Avenue	Mushy Drive	256	1.20	4875
11.8	95	Aquidneck	Winter Con	91	0.52	4500
11.8	38	Aquidneck	+Dye	97	0.52	4825
11.7	25	Marine Avenue	Failed System	78	1.20	1525
11.3	35	Cedar Avenue	No Evidence	64	1.20	1440
10.6	119	Seaconnet	+Dye	160	1.20	3825
9.9	431	Park Avenue	Susp. Stai	166	1.20	4260
9.7	57	Green Street	Leak Soak	133	1.20	3480
9.4	52	Pine Street	No Contact	103	1.20	2500
9.3	29	Aquidneck	New Sys	57	0.52	3600
9.2	9	Aquidneck	No Evidence	71	0.52	4500
9.2	105	Park Avenue	+Dye	156	0.52	9900
9.1	74	Tallman Avenue	Drip Fauce	130	0.52	7500
8.8	107	Tallman Avenue	Susp. Laun	134	0.52	8000
8.1	57	Cottage Avenue	New Sys 2	81	1.20	2275
8.1	46	Cottage Avenue	New Sys 6	104	1.20	2925
7.6	12	Atlantic Avenue	2' From St	26	0.52	2000
7.6	163	Cedar Avenue	Failed System	168	1.20	5621
7.5	534	Park Avenue	Burnt Lawn	106	1.20	3570
7.5	51	Cedar Avenue	No Contact	87	1.20	2955
7.5	8	Atlantic Avenue	Faucet Lea	51	0.52	4000
7.4	79	Douglas Avenue	Pump 1/Yr	105	0.52	7500
7.3	22	Narragansett	No Evidence	50	0.52	3600
6.9	2	Atlantic Avenue	+Dye	45	0.52	3840
6.2	53	Atlantic Avenue	No Evidence	65	0.52	6180
6.0	17	Norseman Drive	Burnt Lawn	114	0.52	10000
5.9	15	Point Road	New Sys	224	1.20	9703
5.1	25	Atlantic Avenue	Seawall	57	0.52	6520
2.9	82	Aquidneck	+Dye Water	54	0.52	10720
6.1	21	Aquidneck	New Sys	54	0.52	5220
7.2	33	Cedar Avenue	Shore Ok	50	1.20	1770

Table 8 – Continued

RHODY#	House	Street	Comment	MAX	SOIL	SQ FT
7.0	54	Cedar Avenue	No Evidence	76	1.20	2755
6.9	218	Cedar Avenue	Shore Ok	51	1.20	1875
6.9	220	Cedar Avenue	Shore Ok	51	1.20	1875
6.6	230	Cedar Avenue	Shore Ok	49	1.20	1875
6.5	222	Cedar Avenue	Shore Ok	48	1.20	1875
5.8	203	Cedar Avenue	Shore Ok	31	1.20	1350
5.6	58	Cedar Avenue	No Evidence	70	1.20	3195
5.6	45	Cedar Avenue	Shore Ok	67	1.20	3060
5.9	26	Cottage Avenue	Shore Ok	84	1.20	3250
5.9	88	Cove Street	Shore Ok	150	1.20	5790
5.7	14	Cove Street	Shore Ok	90	1.20	3600
6.4	89	Gormley Avenue	Shore Ok	91	1.20	3250
5.5	64	Green Street	Shore Ok	113	1.20	5200
6.4	132	Highland Avenue	Shore Ok	211	1.20	7500
6.1	13	Island Avenue	Shore Ok	72	1.20	2700
5.5	111	Mason Avenue	Shore Ok	79	1.20	3250

5.4.4 NEW ALTERNATIVE SEWAGE TREATMENT METHODS

Phase II of the project involved researching new and alternative sewage treatment technologies as well as financing strategies and funding mechanisms. Some of the technologies evaluated to mitigate contamination from failed septic systems in Portsmouth Park and Island Park include:

1. Conventional septic systems
2. Advanced technology septic systems
3. Septic tanks with community effluent collection and beneficial water reuse in a new water recycling center
4. Septic tanks with community effluent collection and piping to an existing Wastewater Treatment Facility (WWTF).
5. Sewage collection and treatment in a new WWTF
6. Sewage collection and piping to an existing WWTF
7. Irrigation wells and tree planting

To mitigate stormwater related pollution various technologies were also evaluated such as:

1. Catch basin retrofitting
2. Wet ponds and detention basins
3. Infiltration basins, trenches, and dry wells
4. Vegetated strips
5. Revived or constructed wetlands
6. "Vortex type" separators

Financial and technical assistance for septic system repair/replacement and stormwater treatment technologies was also presented. The various funding sources investigated were:

1. State Revolving Fund
2. Aqua Fund
3. Sewer and Water Supply Failure Fund
4. Housing and Urban Development: Community Development Block Grants
5. Housing and Urban Development: 203(k) Loan
6. Housing and Urban Development: Title 1 Loans
7. USDA/Farmers Home Administration: 504 Loan/Grant
8. USDA/Rural Development Administration Loans and Grants
9. Rhode Island Housing and Mortgage Financing Corporation Loans
10. Other Private Lenders

5.5 RIDOH BEACH MONITORING PROGRAM

The Rhode Island Department of Health currently samples licensed, public beaches for total and fecal coliform. The results are analyzed for information necessary to safely and effectively manage the beaches to protect swimmers from water-borne illness. The regular monitoring season runs from mid-May to mid-September. All beaches that currently hold a license are monitored at varying intervals depending on the historical water quality conditions at the site. Limited testing is conducted at currently closed, licensed beaches.

5.5.1 RIDOH BEACH MONITORING PROGRAM – TEDDY'S BEACH

Teddy's Beach located at the eastern end of Island Park on the Sakonnet River shore is a licensed, closed beach. Table 9 represents the results of the most recent testing at Teddy's Beach. The current annual sample results suggest that the fecal coliform concentrations at Teddy's Beach are well within the beach recreational water quality standards of 50 fecal coliform MPN/100ml for saltwater bathing beaches. No sampling took place in 2000 per the RIDOH.

The stretch of sand along the southern shore of Island Park locally referred to, as Island Park beach has never been open as a licensed or public beach. Therefore, the only water quality data available for this area is from the RIDEM Shellfish Programs monitoring station number 20 located offshore in the Sakonnet River.

Table 8. Teddy's Beach, Portsmouth, RI – Fecal Coliform Results, 1995 – 1999

Sample Date	Fecal Coliform MPN / 100
June 20, 1995	4
May 22, 1996	0
May 12, 1997	15
May 14, 1998	4
May 20, 1999	9

5.6 RIDEM FWA INVESTIGATIONS

In 1998 a RI Aqua Fund and RIDEM report entitled "A Method for Quantifying Fluorescent Whitening Agents in Estuarine and Freshwater Samples" was prepared. Fluorescent whitening agents (FWAs) are chemical additives to laundry detergent, which brighten fabrics. The brightening effect of FWAs is due to the fluorescent characteristic of the compounds. FWAs absorb ultraviolet light in the UV portion of the spectrum and emit long wave blue light (Anliker et al., 1992). Because textiles develop a natural yellow color over time, the blue light emitted from FWAs counteracts the yellow color and gives the fabric a bright white color. While FWAs show strong absorbency to fabrics, some FWAs may remain in the washing liquor and be extruded into the environment with the wastewater (Bode, 1975). Therefore the presence of FWAs in the environment is an indicator of anthropogenic sources of pollution in the region from which the FWAs were isolated.

FWAs are primarily removed from the environment by photodegredation. The half-life of FWAs on the surface of a body of water may be as short as 5 hours under noon sunlight. However when wastewater is released into the environment below the photic zone, FWAs can persist in the environment. Additionally, FWAs may absorb onto sediments and prolong their existence in the environment. Giger and Stoll reported finding FWAs in sediments from a small lake in Switzerland at concentrations 10,000 times greater than FWAs in the surface water (Giger & Stoll, 1997). Further details as to the presence of FWA's in wastewater are provided in the full report.

In addition to the methodology report, additional past RIDEM studies have determined that failing septic systems along with illegal sewer connections to storm drains has contributed to anthropogenic pollution that impacts the receiving waters. This research was designed to test for FWAs in the storm drains emptying into the receiving waters, and confirm the prior observations made by RIDEM.

In this experiment a portable field fluorometer was used to determine the concentrations of FWAs in storm drains in the Morningside Lane and Aquidneck Avenue, Narraganset Avenue neighborhood in Portsmouth, Rhode Island.

5.6.1 RESULTS OF FIELD INVESTIGATIONS

Two separate field surveys were conducted. A survey on September 9, 1999 was conducted under dry weather conditions and nine stations were analyzed. FWA concentrations ranged from 7.07 ppb to 31.58 ppb. A second survey on October 22, 1999 was conducted after a heavy rainstorm and, therefore, considered a wet weather survey. Seven stations were analyzed and concentrations of FWAs ranged from 5.79 ppb to 12.96 ppb. The data is summarized in Table 10. Figure 14 is a layout of the sampling locations within the Portsmouth Park area.

Concentrations of FWAs were decreased during the wet weather survey for stations 2, 3, 5, and 6 (refer to Figure 14). Station 2 is the outflow of a storm drain. Flow from stations 3, 4, 5, 5a, and 6 all empty into the Sakonnet River at station 2. The decreases in FWA concentrations after a heavy rainfall were expected. Station 1 was an outflow pipe that drains ground water and was therefore unaffected by the rainstorm. The concentration of FWAs was only slightly less from this station in the wet weather survey.

During both surveys it was observed that concentrations of FWAs decreased from station 2 to 6. FWA concentration was also decreased when moving away from the storm drain (station 4). The soil topology of the area allows for accumulation of pollutants at the outflow of the drainage basin. FWA concentrations are in agreement with this observation.

Results from stations 7, 8, and 9 were used to identify an illegal wastewater discharge into a storm drain (refer to Figure 14). A garden hose was discharging water that had a strong bleach smell into the drain between stations 8 and 9. Station 7 is the outflow of the storm drain where the wastewater was being discharged. Stations 7 and 8 had FWA concentrations significantly higher than station 9. Without knowing of the illegal discharge into the storm drains, one could conclude that there was a significant point source of FWAs between stations 8 and 9. The illegal discharge could account for the elevated levels of FWAs into the storm drain.

Figure 14 –Sampling Locations Sampled For FWAs in 1999

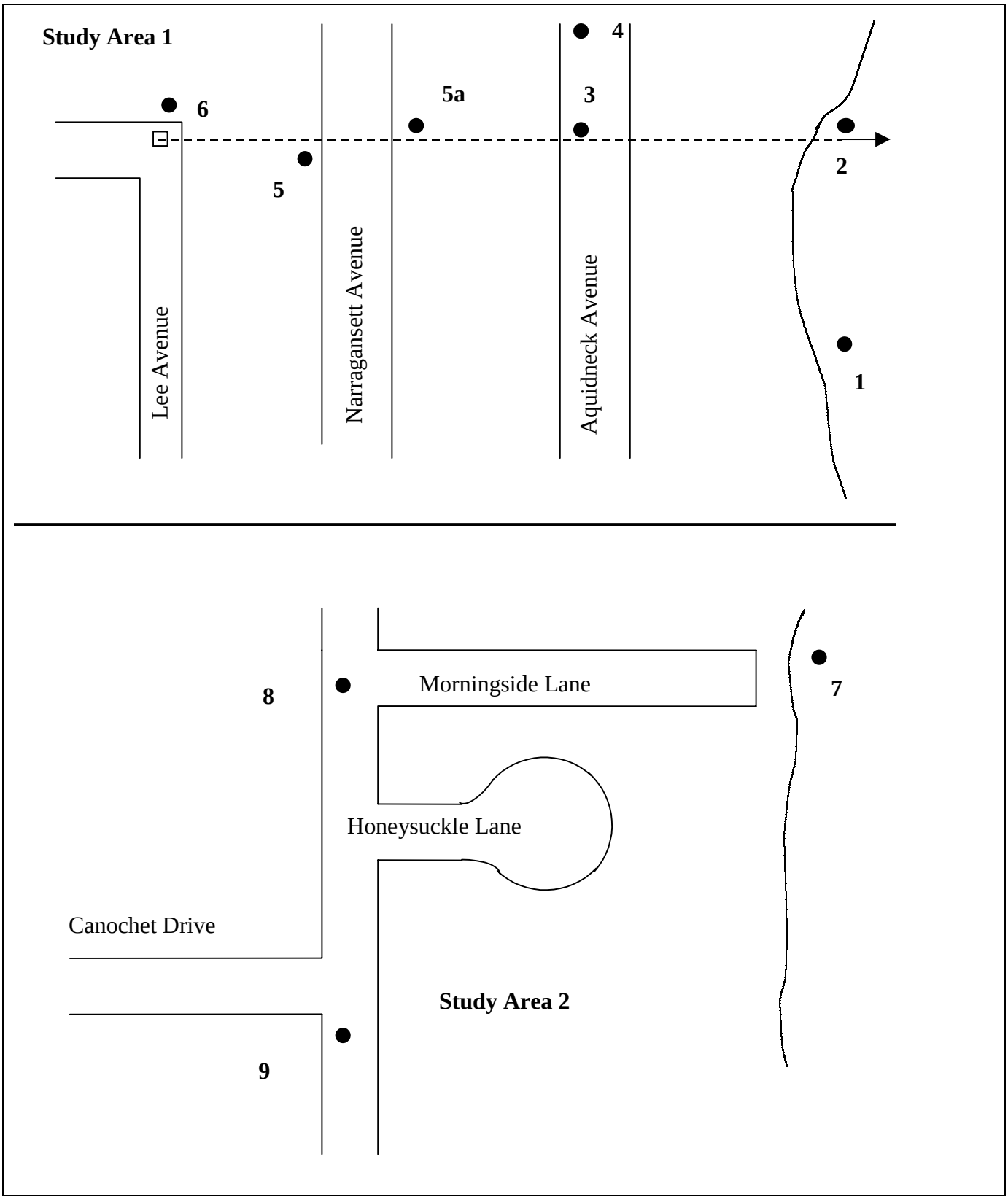


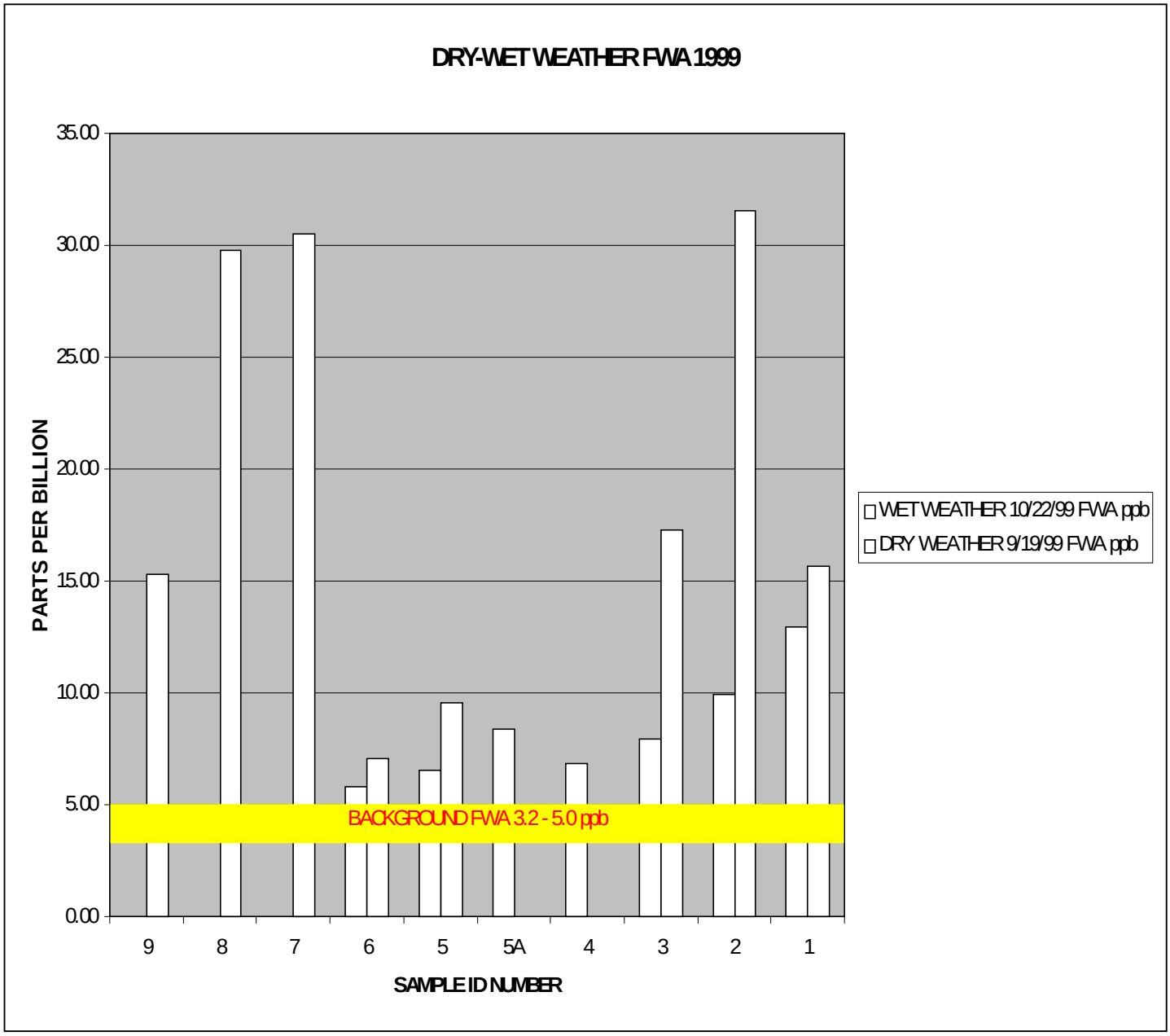
Table 9. Concentrations of FWAs from stations in Portsmouth, RI

Station	FWA Concentrations (ppb)	
	9/19/99 Survey	10/22/99 Survey
1	15.65	12.96
2	31.58	9.92
3	17.25	7.94
4	Not sampled	6.85
5	9.57	6.53
5a	Not sampled	8.38
6	7.07	5.79
7	30.5	Not sampled
8	29.76	Not sampled
9	15.33	Not sampled

Findings indicate that FWAs are present within the Portsmouth Park stormdrain system (Table 9 and Figure 15). Several samples were collected from uncontaminated sites and background levels of FWAs were recorded (background levels varied from 3.23 ppb to 5.01 ppb for four different sites). The concentration of FWAs is highest at the outlet and steadily decreases moving up into the drainage system. Dry weather flows parallel FWA concentrations with flows heaviest at the outlet and decreasing moving up into the system.

The constant year round dry weather flows observed in this drainage system indicate that flows can be attributed to groundwater infiltration, combined with the evidence of FWAs in dry weather flows, is an indication that the contamination source is from failing septic systems and illegal connections. The decrease in FWA concentrations in wet weather is due to dilution from an increase in stormwater volume in the storm drains.

Figure 15 - Dry-Wet Weather FWA Sampling Results



6 WATER QUALITY CHARACTERISTICS

Water quality in both the Sakonnet River (Portsmouth Park) and The Cove (Island Park) is primarily threatened by non-point sources. The presence of old and failing ISDS and illegal connections to stormdrains, combined with the aged stormwater drainage system, provides the opportunity for untreated and/or partially treated septage to enter the waterbody. Antiquated and failing septic systems, constructed in high groundwater in the Portsmouth Park and in unsuitable soils in Island Park, is the most likely source of both dry and wet weather fecal coliform loadings to these waterbodies. Runoff from impervious surfaces in tightly clustered development sites in both Portsmouth Park and Island Park also contributes to wet weather loadings.

An evaluation of the pollution sources that may affect water quality near Portsmouth Park and Island Park led to the designation of those shellfishing areas as prohibited by RIDEM's Shellfish Program. The suspected continuation of septic system failures within these communities and the current inability to mitigate the sources has maintained the current classification.

Shellfish Program reports suggest that elevated fecal coliform levels are not detected during the routine ambient water quality monitoring (sampled during both dry and wet weather conditions) because of the strong tidal currents found throughout the upper sections of the Sakonnet River. It is possible that high concentrations are getting diluted upon discharge and are undetectable, at the sample locations. There may also be a large enough tidal current present within The Cove to sufficiently dilute inputs to that area.

6.1 DRY WEATHER CHARACTERISTICS

Portsmouth Park

A compilation of RIDEM shoreline survey samples (1987 survey and follow-up monitoring, 1990 survey) and with the RIDEM OWR study samples of the Portsmouth Park area were combined and evaluated (Figure 16, locations refer to Figure 13). Five out of the seven stormdrains exceed shellfishing standards and swimming standards during dry weather. Geometric mean dry weather concentrations for the two largest sources, which were a magnitude larger than the other sources (P5 & P6), are 5,408 MPN/100 ml and 27,044 MPN/100 ml respectively.

Island Park

Two discharge pipes (636 Park Avenue and 197 Cedar Avenue) where identified as problem discharges in the 1987 shoreline survey. Four samples taken from the Cove in the 1990 shoreline survey were identified as possibly failing septic systems. One source sampled in the most recent shoreline survey (2000) was a groundwater seep within the vicinity of a house located on Point Street, and was identified as a possible failing septic system due to a septic odor and high fecal coliform count (23,000 MPN/100 ml). Approximately nine (9) failing septic systems were identified in Island Park in the RIDEM OWR study of this area. A variety of enforcement efforts are presently underway to address these identified pollution sources through DEM's Office of Compliance and Inspection. Refer to Appendix A for the current status of these enforcement actions.

6.2 WET WEATHER CHARACTERISTICS

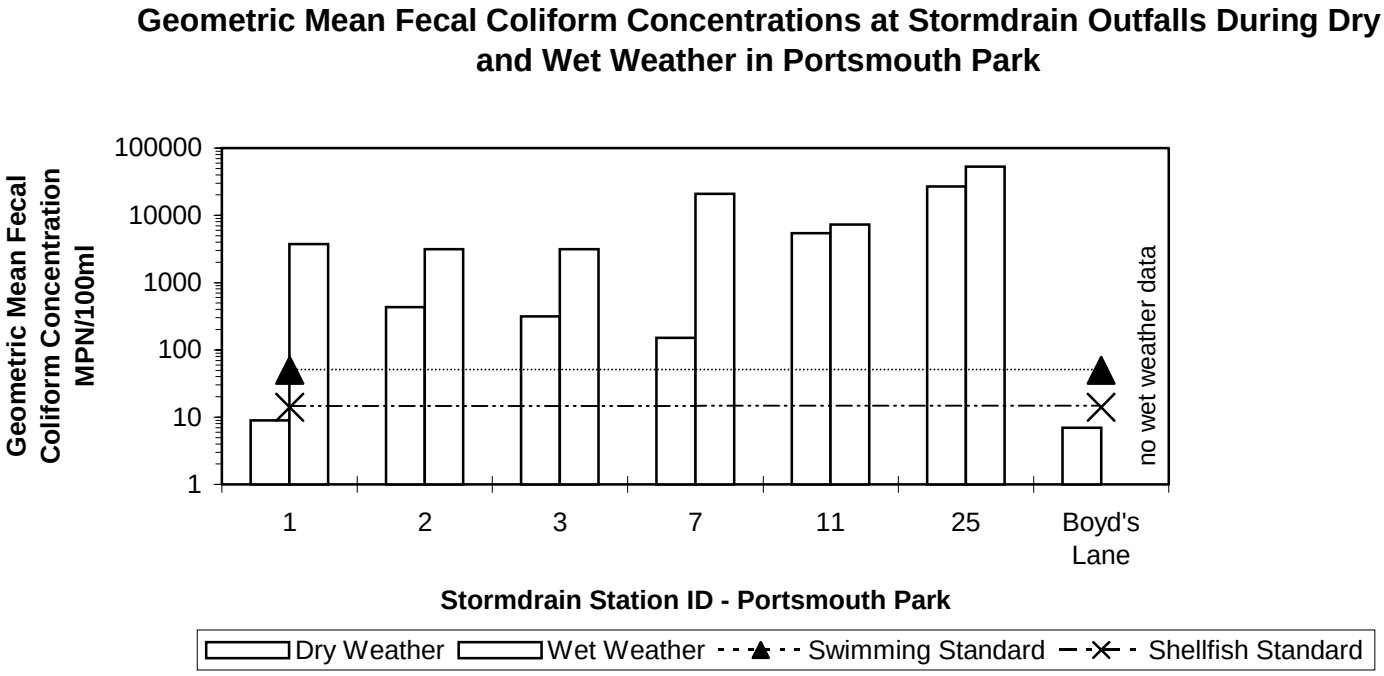
Portsmouth Park

The RIDEM OWR study samples of the Portsmouth Park area (Figure 15, locations refer to Figure 12) reveal that all six stormdrains sampled during wet weather exceed both shellfishing and swimming standards. Geometric mean wet weather concentrations for the two largest sources, which were 1-2 magnitudes larger than the other sources (P4 & P6), are 20,592 MPN/100 ml and 52,937 MPN/100 ml respectively. Wet weather samples collected are grab samples and it is not clear what the full extent of an impact from a wet weather event will have on the Upper Sakonnet River.

Island Park

No wet weather sampling data is available for this portion of The Cove. It is recognized that in conjunction with the existing dry weather contamination sources, and the numerous ten – twelve inch drainage pipes that would presumably flow during a rain event scattered through out the area, there is a potential for impact during wet weather events.

Figure 16 – Geometric Mean Fecal Coliform Concentrations



7 TARGETED WATER QUALITY GOALS

The Sakonnet River (Portsmouth Park) and The Cove (Island Park) are designated as Class SA waterbodies. The fecal coliform standard for Class SA waters specifies that the maximum allowable level of fecal coliform bacteria (Most Probable Number (MPN) per 100 milliliter) may not exceed a geometric mean MPN value of 14, and not more than 10% of the samples shall exceed an MPN value of 49, for a three-tube decimal dilution (Water Quality Regulations, 1997). The results of the numerous water quality studies indicate that this standard is not maintained, and therefore these waterbodies do not support all of their designated uses, particularly the value of shellfish harvesting for human consumption.

The objective of the Sakonnet River (Portsmouth Park) and The Cove (Island Park) TMDL is to identify and eliminate the threat of nonpoint source loadings into the waterbody and to restore the waterbody to a condition that supports all of its designated uses, and to protect the area from any future degradation.

Addressing the high fecal coliform concentrations present in the storm drain system, minimizing non-point source loadings from failing septic systems, and establishing a Management Plan to maintain properly functioning individual septic systems, will reduce the threat of discharging pollution into the Sakonnet River and the Cove.

The work completed to date has identified numerous sources of actual and potential contamination to these two waterbodies. Failed or failing septic systems, numerous illicit connections, contaminated dry weather ground water flows in stormdrains, high FWA concentrations, high density land uses and the existing soil limitations all lead to the conclusion that this is, and will continue to be a chronic problem of these two areas. The complexity and widespread variety of sources can not be dealt with solely on a site by site basis, but must be handled within the context of a community based action plan to reduce overall pollution. RIDEM's Office of Compliance and Inspection will continue to address individual complaints and notice of failures as allowed for under current statute and policy.

In Portsmouth Park the town must identify and mitigate the illegal connections to reduce pollution loadings associated with storm drain dry weather flows, along with the institution of a community wide waste water management system incorporating Best Management Practices to deal with contaminated ground water flows in order to eliminate the pollution loadings to the Sakonnet River.

The town's efforts should also identify and mitigate failing or failed septic systems within Portsmouth Park to prevent the continued contamination of ground water and in Island Park to mitigate the suspected contaminated seepage in to Blue Bill Cove due to the rapidly drained soils.

The Town of Portsmouth's development of their Wastewater Facilities Plan Update will address these well documented issues and will provide an action plan that will assist the community in reaching the water quality goals that these waterbodies support all of their designated uses.

8 REFERENCES

Comprehensive Community Plan, September 1992, Town of Portsmouth, RI (a cooperative effort of the Town Council, Planning Board, Town Planner, and the Portsmouth Citizen Advisory Committee)

Historic and Architectural Resources of Portsmouth, Rhode Island: A Preliminary Report. Rhode Island Historical Preservation Commission. January 1979.

National Shellfish Sanitation Program Guide For The Control of Molluscan Shellfish, Interstate Shellfish Sanitation Conference, US Department of Health and Human Services, Public Health Service, Food and Drug Administration, 1997 Revision.

Report to the Town of Portsmouth, RI, Wastewater Facilities Volume 1. January 1981. Metcalf and Eddy, Inc.

Save the Bay, Technical Report No. 2. Wastewater Systems on Aquidneck Island, March 1983

Schmidt, R.P., Draft Project Report "Development of Remediation methodology to Mitigate Sewage Contamination of Portsmouth Park & Island Park, Portsmouth, Rhode Island. RIDEM, March 1998.

Shellfish Program Shoreline Survey Reports. RIDEM Office of Water Resources. 1987-1998.

Shellfish Growing Area Monitoring Program 1998 Review: Statistical Evaluation and Comments. Jon C. Speaker. RIDEM, March 1999.

Shellfish Closure Areas. May 1999 – May 2000. Narragansett Bay. RIDEM

Soil Survey of Rhode Island. Issued July 1981. United States Department of Agriculture Soil Conservation Service in cooperation with Rhode Island Agricultural Experiment Station.

State of Rhode Island 1998 303(d) List, List of Impaired Waters. RIDEM Office of Water Resources. December 1998.

State of the State's Waters - Rhode Island Section 305(b) Report. RIDEM Office of Water Resources. December 1998.

Technical Report No. 2. Wastewater Systems on Aquidneck Island. Save the Bay. March 1983

Tiner, R.W. Wetlands of Rhode Island. U.S. Fish and Wildlife Service. Newton Corner, MA. September 1989.

Waste Water Management Districts…A Starting Point. RI Department of Administration, Division of Planning. Report Number 62. December, 1987 Wastewater Facilities Plan (WWFP) Update for the Island Park and Portsmouth Park areas of the Town of Portsmouth, Proposal, Portsmouth, Rhode Island, May, 1999.

Water Quality Regulations, 1997. RIDEM Office of Water Resources. August 6, 1997.

Fluorescent Whiting Agents. Anliker, R.; Muller, G.; eds. Georg Thieme Publishers: New York, 1992

Bode, K. *Tenside Detergent*. 1975, 12, p. 69-70

Findley, W.R. *Journal of the American Oil Chemists Society*. 1988, 65 (4), p. 679

Stana, K.K; Pohar, C.; Ribitsch, C. *Colloid and Polymer Science*. 1995, 273 (12), p. 1775

Ganz, C.R. *Environmental Science and Technology*. 1975, 9, 738

Poiger, T.; Field, J.A.; Field, T.M.; Giger, W. *Environmental Science and Technology*. 1996, 30 (7), p. 2220-2226

Burg, A.; Rohovsky, M.; Kensler, C. Current States of Human Safety and Environmental Aspects of Fluorescent Whitening Agents Sued in Detergents in the United States. CRC, 1977, p. 96.

Williams, R.T. *Journal Royal Institute of Chemistry*. 1959, 83, p. 611

Stoll, J.A.; Giger, W. *Analytical Chemistry*. 1997, 69 p. 2594-2599

APPENDIX A

Study Area:

IP - Island Park

PP - Portsmouth Park

The following key applies to the current status descriptions:

CONFORMED-	The system has been made to conform to applicable standards
FNOTICE-	Failure notice issued
NOI-	Notice of Intent
NOI-C	Notice of Intent (Non-Compliance)
NOI-I	Notice of Intent (Illegal)
NOI-N	Notice of Intent (Sewerage Overflow)
RELEASE NOI	Release of Notice of Intent or Violation
FNOTICE	Final Notice
UNF	Unfounded Complaint

Note that the following is a list of enforcement cases and actions taken as a result of complaints received in the Office of Compliance and Inspection. It should not be construed as a complete list of possible septic system problems, failures, illegal systems, or other septic system issues that may exist within the Portsmouth Park and Island Park neighborhoods.

Enforcement Number	Street Number	Street Name	Study Area	Current Status
C194-0003	36	COVE STREET	IP	CONFORMED
C191-0180	494	PARK AVENUE	IP	CONFORMED
C194-0127	362	PARK AVENUE	IP	CONFORMED
C192-128	16	RIVERSIDE STREET	IP	CONFORMED
C199-0052	14	COTTAGE AVENUE	IP	FNOTICE
C194-0014	501	PARK AVENUE	IP	NOI-C
C194-0013	20	POINT ROAD	IP	NOI-C
C192-0062	91	RUSSELL AVENUE	IP	NOI-C
C199-0076	126	SEACONNET BLVD	IP	NOI-C
C194-0400	109	POINT ROAD	IP	NOI-I
C100-0227	35	COVE STREET	IP	NOI-N
C191-0324	32	MORGAN STREET	IP	NOI-N
IS86-0067	227	CEDAR AVENUE	IP	NOV-N
IS89-0039	197	CEDAR AVENUE	IP	NOV-N
IS87-0082	562	PARK AVENUE	IP	NOV-N
C195-0210	97	MASON AVENUE	IP	RELEASENOI
C191-0017	657	PARK AVENUE	IP	RELEASENOI
C194-0089	364	PARK AVENUE	IP	RELEASENOI
C193-0610	15	POINT ROAD	IP	RELEASENOI
C191-0325	227	CEDAR AVENUE	IP	RELEASENOV
IS88-0075	640	PARK AVENUE	IP	RELEASENOV
C192-0242	636	PARK AVENUE	IP	RELEASENOV
C198-0147	23	BLUE BILL WAY	IP	UNF
C191-0317	227	CEDAR AVENUE	IP	UNF
C194-0380	163	CEDAR AVENUE	IP	UNF
C195-0219	122	COTTAGE AVENUE	IP	UNF
C195-0323	75	FOUNTAIN AVENUE	IP	UNF
C197-0173	44	GORMLEY STREET	IP	UNF
C100-0038	9	ISLAND STREET	IP	UNF
C191-0351	104	MASON AVENUE	IP	UNF
C192-0160	382	PARK AVENUE	IP	UNF
C193-0319	478	PARK AVENUE	IP	UNF
C199-0142	324	PARK AVENUE	IP	UNF
C196-0291		RIVERSIDE STREET	IP	UNF
C197-0211	22	MORGAN STREET	IP	
IS80-0042	168	RIVERSIDE STREET	IP	
C193-0609	2829	EAST MAIN ROAD	PP	CONFORMED
C194-0002	3001	EAST MAIN ROAD	PP	CONFORMED
C199-0219	62	PRESIDENT'S AVENUE	PP	NOI-G
C194-0422	38	AQUIDNECK AVENUE	PP	NOI-I
C194-0044	2793	EAST MAIN ROAD	PP	NOI-N
C193-0439	38	MORNINGSIDE LANE	PP	NOI-N
C192-0309	145	VALHALLA DRIVE	PP	NOI-N
C100-0095	67	NORSEMAN DRIVE	PP	PENDING
C193-0335	29	AQUIDNECK AVENUE	PP	RELEASENOI
C191-0093	3352	EAST MAIN ROAD	PP	RELEASENOV
IS89-0057	2787	EAST MAIN ROAD	PP	RELEASENOV
C192-0029	30	AQUIDNECK AVENUE	PP	UNF
C199-0186	56	DOUGLAS AVENUE	PP	UNF
C193-0346	3030	EAST MAIN ROAD	PP	UNF
C100-0003	2719	EAST MAIN ROAD	PP	UNF
C198-0243		EDUCATION ROAD	PP	UNF
C192-0190	47	NARRAGANSET AVENUE	PP	UNF
C191-0067	136	NORSEMAN DRIVE	PP	UNF
C193-0283	114	VALHALLA DRIVE	PP	UNF
C193-0271	113	VIKING DRIVE	PP	UNF
C100-0272	97	BIRCHWOOD DRIVE	PP	
C199-0194	370	NARRAGANSET AVENUE	PP	

Appendix B

Summary of Pollution Questionnaire Responses

POLLUTION QUESTIONNAIRE of PORTSMOUTH PARK / ISLAND PARK RESIDENTS

		I	P	T
1.	What neighborhood do you live in?			
	a. Island Park	100%	0%	43%
	b. Portsmouth Park	0%	100%	57%
2.	How close is your house to the water?			
	a. Right on the shoreline.	26%	16%	20%
	b. Second house from the shoreline.	9%	22%	16%
	c. Third from the shoreline.	10%	12%	11%
	d. Fourth from the shoreline.	47%	46%	46%
3.	How many people live in your home?			
	a. 1-2	55%	47%	51%
	b. 3-5	31%	47%	40%
	c. 6-8	7%	3%	4%
	d. 9+	0%	0%	0%
4.	Circle all that you use in your house.			
	a. Clothes Washer	84%	82%	84%
	b. Dishwasher	31%	45%	39%
	c. Sump pump	5%	22%	15%
	d. Garbage disposal	2%	4%	3%
5.	How old is your house?			
	a. 20 + years	91%	88%	90%
	b. 10-19 years	2%	5%	4%
	c. 5-9 years	0%	3%	1%
	d. less than 5 years.	2%	1%	1%
6.	How old is your septic system?			
	a. 20+ years.	43%	59%	52%
	b. 10-19 years.	14%	18%	16%
	c. 5-9 years.	9%	7%	7%
	d. Less than 5 years.	17%	13%	15%
7.	What type of septic system/s do you have?			
	a. Cesspool or pit.	22%	5%	13%
	b. Cesspool and drywell	10%	5%	7%
	c. Septic tank with leachfield.	33%	63%	50%
	d. Do not know.	16%	13%	14%

Name Disclosed		61%
Anonymous		39%
Response Rate		26%

		I	P	T
8.	Do you smell sewage odors in or near your yard?			
	a. Never.	74%	70%	72%
	b. Sometimes.	17%	22%	20%
	c. Frequently.	3%	4%	4%
9.	How often do you pump put your cesspool/septic tank?			
	a. Never needed to or more than 10 years ago.	17%	13%	15%
	b. Once every 6-10 years.	10%	8%	9%
	c. Once every 3-5 years.	21%	37%	30%
	d. Once every 2 years.	26%	20%	22%
	e. Once or twice per year.	17%	18%	18%
	f. Three or more times per year.	0%	0%	0%
10.	Has your septic system been repaired or replaced?			
	a. No.	38%	55%	48%
	b. I don't know.	17%	14%	16%
	c. Yes.	38%	28%	32%
11.	Would you like a free septic system inspection?			
	a. Yes.	24%	28%	26%
	b. No.	60%	59%	60%
12.	Do you think the town should have a program to provide septic system maintenance?			
	a. No.	26%	26%	26%
	b. I'm not sure.	41%	45%	43%
	c. Yes.	26%	25%	25%
13.	Do you have french drains tied into the stormwater pipes? (French drains are used to collect and channel groundwater.)			
	a. Yes.	0%	9%	5%
	b. No.	74%	66%	69%
	c. Do not know.	21%	21%	21%
14.	Do any of your house drains connect to the stormwater pipes?			
	a. No.	74%	76%	75%
	b. I'm not sure.	19%	16%	17%
	c. Yes, but not toilet water.	2%	4%	3%
	d. Yes.	0%	0%	0%